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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use It*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

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STAR is a comprehensive abstracting and indexing journal covering current worldwide *report* literature on the science and technology of space and aeronautics. Publications abstracted in *STAR* include scientific and technical reports issued by NASA and its contractors, other U.S. Government agencies, corporations, universities, and research organizations throughout the world. Pertinent theses, translations, NASA-owned patents and patent applications, and other separate documents are also abstracted. Citations and abstracts in *STAR* are grouped in 34 subject categories, although accession numbers run in unbroken sequence through the *STAR* issues, without regard to category assignment.

Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

STAR, issued on the 8th and 23rd of each month, is available to the public on subscription from the Superintendent of Documents, U.S. Government Printing Office, as noted on the inside cover. *STAR* is sent without charge to qualified organizations registered with NASA as described in the paragraph *Eligibility and Registration for NASA Information Products and Services*.

ABSTRACTS OF NONREPORT LITERATURE

By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly, *IAA* being issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics. Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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In the citation of each NASA-supported document and of some non-NASA documents is a code (e.g., CSCL 25A) that indicates the subject category assigned to it from the COSATI Subject Category List (first ed. December, 1964) published by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology.

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Denver, Colorado 80225

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 846
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 851
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 853
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 855
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 862
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 864
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 873
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 876
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 878
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 879
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 882
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 888
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 895
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 902
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 907
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

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18 Materials, Nonmetallic 914
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 920
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 923
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 926
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 927
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

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26 Physics, Solid-State 945
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

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Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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28 Propulsion Systems 950
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 957
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 958
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 960
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 961
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 985
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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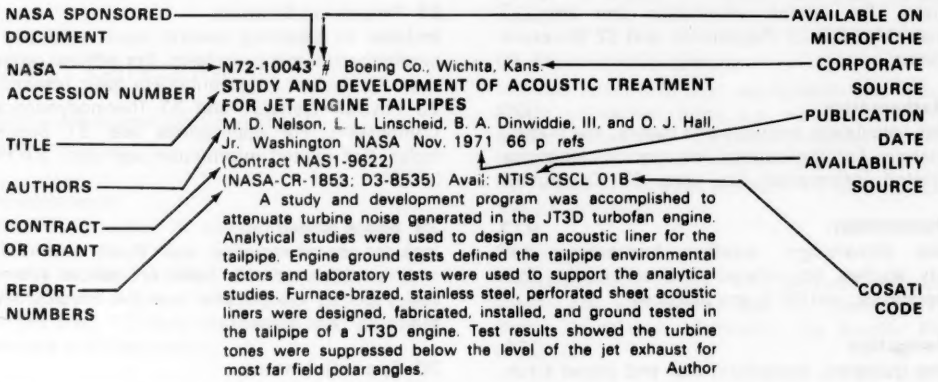
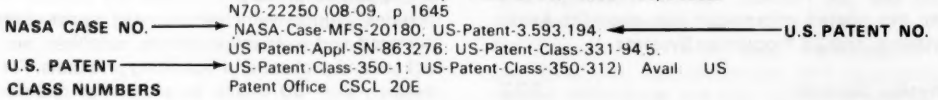


N72-10043* # Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

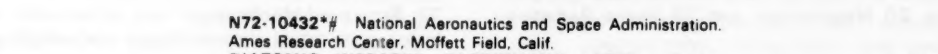
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION



N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA) Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION



N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

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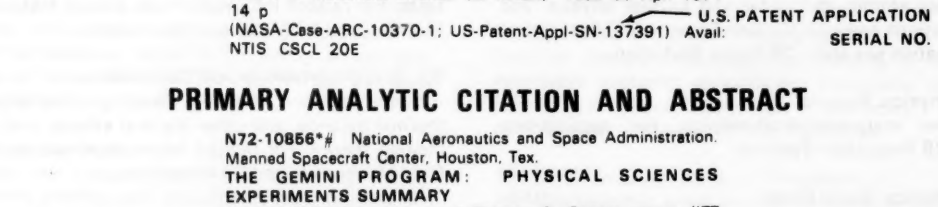
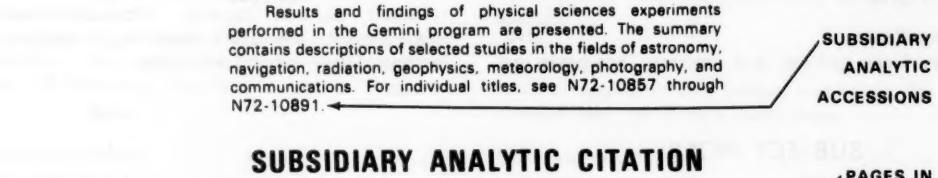


N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp., Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 7 / APRIL 8, 1972

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-15940*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INITIAL ROTATION-LOADING AND LOW SPEED FLUTTER TEST RESULTS FOR A STRAIGHT WING VERSION OF THE SPACE SHUTTLE VEHICLE
Robert W. Warner, Phillip R. Wilcox, and Bruno J. Gambucci Jan. 1972 74 p refs
(NASA-TM-X-62110) Avail: NTIS CSCL 01A

For three straight semispan model space shuttle wings, the maximum total load during rapid rotation from 66 deg to 0 deg angle of attack, at Mach numbers from 0.28 to 0.60, was essentially no higher than that measured for buffet. During slow rotation over the same angle range, there was no visible flutter. For one of the wings, however, unstable aerodynamic damping was established at two fixed angles of attack. Author

N72-15941*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
REVIEW OF DELTA WING SPACE SHUTTLE VEHICLE DYNAMICS Final Technical Report
J. Peter Reding and Lars E. Ericsson Oct. 1971 164 p refs
(Contract NAS9-11445)
(NASA-CR-115357; LMSC-D243938) Avail: NTIS CSCL 01A

The unsteady aerodynamics of the proposed delta planform, high cross range, shuttle orbiters, are investigated. It is found that these vehicles are subject to five unsteady-flow phenomena that could compromise the flight dynamics. The phenomena are as follows: (1) leeside shock-induced separation, (2) sudden leading-edge stall, (3) vortex burst, (4)bow shock-flap shock interaction, and (5) forebody vorticity. Trajectory shaping is seen as the most powerful means of avoiding deterimental effects of the stall phenomena; however, stall must be fixed or controlled when traversing the stall region. Other phenomana may be controlled by carefully programmed control deflections and some configuration modifications. Ways to alter the occurrence of the various flow conditions are explored. Author

N72-15942*# Chrysler Corp., New Orleans, La. Space Div.
SURFACE PRESSURE AND INVISCID FLOW FIELD PROPERTIES OF THE MCDONNELL-DOUGLAS DELTA-WING ORBITER FOR NOMINAL MACH NUMBER OF 8, VOLUME 1
J. D. Warmbrod, M. R. Martindale, and R. K. Matthews Jan. 1972 81 p
(Contract NAS8-4016)
(NASA-CR-120037-Vol-1; DMS-DR-1225-Vol-1; NASA-Ser-H-1009; DRC-184-58) Avail: NTIS CSCL 20D

The results of a wind tunnel test program to determine the surface pressures and flow distribution on the McDonnell Douglas Orbiter configuration are presented. Tests were conducted in hypersonic wind tunnel at Mach 8. The freestream unit Reynolds number was 3.7 time one million per foot. Angle of attack was varied from 10 degrees to 60 degrees in 10 degree increments. Author

N72-15943*# Georgia Inst. of Tech., Atlanta.
EXPLORATORY INVESTIGATION OF SOUND PRESSURE LEVEL IN THE WAKE OF AN OSCILLATING AIRFOIL IN THE VICINITY OF STALL
Robin B. Gray and G. Alvin Pierce Washington NASA Feb. 1972 48 p refs
(Grant NGR-11-002-121)
(NASA-CR-1948) Avail: NTIS CSCL 20D

Wind tunnel tests were performed on two oscillating two-dimensional lifting surfaces. The first of these models had an NACA 0012 airfoil section while the second simulated the classical flat plate. Both of these models had a mean angle of attack of 12 degrees while being oscillated in pitch about their midchord with a double amplitude of 6 degrees. Wake surveys of sound pressure level were made over a frequency range from 16 to 32 Hz and at various free stream velocities up to 100 ft/sec. The sound pressure level spectrum indicated significant peaks in sound intensity at the oscillation frequency and its first harmonic near the wake of both models. From a comparison of these data with that of a sound level meter, it is concluded that most of the sound intensity is contained within these peaks and no appreciable peaks occur at higher harmonics. It is concluded that within the wake the sound intensity is largely pseudosound while at one chord length outside the wake, it is largely true vortex sound. For both the airfoil and flat plate the peaks appear to be more strongly dependent upon the airspeed than on the oscillation frequency. Therefore reduced frequency does not appear to be a significant parameter in the generation of wake sound intensity. Author

N72-15944*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MULTIPLE-ORIFICE LIQUID INJECTION INTO HYPERSONIC AIRSTREAMS AND APPLICATIONS TO RAM C-3 FLIGHT
William L. Weaver Washington Feb. 1972 68 p refs
(NASA-TM-X-2486; L-8023) Avail: NTIS CSCL 20D

Experimental data are presented for the oblique injection of water and three electrophilic liquids (fluorocarbon compounds) through multiple-orifice nozzles from a flat plate and the sides of a hemisphere-cone (0.375 scale of RAM C spacecraft) into hypersonic airstreams. The nozzle patterns included single and

multiple orifices, single rows of nozzles, and duplicates of the RAM C-III nozzles. The flat-plate tests were made at Mach 8. Total pressure was varied from 3.45 MN/m2 to 10.34 MN/m2, Reynolds number was varied form 9,840,000 per meter to 19,700,000 per meter, and liquid injection pressure was varied from 0.69 MN/m2 to 3.5 MN/m2. The hemisphere-cone tests were made at Mach 7.3. Total pressure was varied from 1.38 MN/m2, to 6.89 MN/m2, Reynolds number was varied from 3,540,000 per meter to 17,700,000 per meter, and liquid-injection pressure was varied from 0.34 MN/m2 to 4.14 MN/m2. Photographs of the tests and plots of liquid-penetration and spray cross-section area are presented. Maximum penetration was found to vary as the square root of the dynamic-pressure ratio and the square root of the total injection nozzle area. Spray cross-section area was linear with maximum penetration. The test results are used to compute injection parameters for the RAM C-3 flight injection experiment. Author

N72-15945*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF REYNOLDS NUMBER ON OVERALL PERFORMANCE OF A 3.7-INCH-DIAMETER SIX-STAGE AXIAL-FLOW COMPRESSOR

Laurence J. Heidelburg and Calvin L. Ball Washington Feb. 1972 21 p refs

(NASA-TN-D-6628; E-6522) Avail: NTIS CSCL 20D

A 9.4-centimeter (3.7-in.) diameter six-stage axial-flow compressor was tested in argon over a range of inlet pressures corresponding to a Reynolds number range of 30,600 to 160,000. The effect of Reynolds number on efficiency, pressure ratio, work input, maximum flow, and surge is shown. The Reynolds number effects are discussed in terms of changes in boundary-layer thickness, losses, and the resulting changes in throughflow velocity. Significant deviation was noted from the 0.2 power relation often used to express the variation of loss with Reynolds number. Author

N72-15946# National Research Council of Canada, Ottawa (Ontario).

THE DEFLECTION OF FREE JETS AT CONVEXLY CURVED WALLS (COANDA EFFECT)

H.-H. Fernholz 1971 103 p refs Transl. into ENGLISH from Zur Umlenkung von Freistrahlen an Konvex Gekruemmten Waenden (Coanda-effekt), Deutsche Luft- und Raumfahrt Forschungsbericht 66-21, Apr. 1966, DVL-487

(NRC-TT-1504; DVL-487) Avail: NTIS

Theoretical investigations of viscous wall jets are reviewed. The derivation of an approximate integral method is presented for calculating the separation region of the wall jet. The discussion of several experimental investigations reveals laws for the development of curved wall jets and permits the assessment of the importance of certain flow parameters. Finally, some experiments of wall jets along highly curved walls are described. These deal with a strong three-dimensional interference effect caused by the presence of side walls. Author

N72-15947# Loughborough Univ. of Technology (England). Dept. of Transport Technology.

ON THE INFLUENCE OF CAMBER AND NONPLANAR VORTEX WAKE ON AEROFOIL CHARACTERISTICS IN GROUND EFFECT

B. Maskew Oct. 1971 57 p refs

(TT-7112) Avail: NTIS

The theoretical influence of camber and nonplanar wake on the change of lift, vortex drag, and center of pressure of an airfoil with ground effect is discussed. Calculations are performed for both two and three dimensional potential flows for ground effect conditions which are fairly representative of a conventional aircraft in high lift configuration. The calculated results demonstrate the importance of including the influence of camber, incidence, and nonplanar wake in practical ground effect calculations. It is concluded that the effect can be unfavorable in terms of lift and less favorable in terms of vortex drag. Author

N72-15948# National Physical Lab., Teddington (England). Aerodynamics Div.

PRESSURES NEAR THE CENTRE-LINE OF LEEWARD SURFACES ON DELTA WINGS AND CONICAL BODIES AT HIGH SUPERSONIC SPEEDS

M. J. Larcombe Jun. 1970 26 p refs

(NPL-AERO-1319; ARC-32172) Avail: NTIS

Flow fields over the leeward surfaces of delta wings and conical bodies are calculated for conditions when the bow shock wave is detached from the leading edges. The parameters controlling the flow process are determined. An accurate semi-empirical method is developed for predicting pressure near the centerline of wings and bodies for Mach numbers greater than 2.5. Author (ESRO)

N72-15949# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

MEASUREMENTS OF SECTION PRESSURE DISTRIBUTION AT A MACH NUMBER OF 2.0 ON A WING OF 70 DEG SWEEP MOUNTED ON A WAISTED BODY

K. G. Winter and K. G. Smith London Aeron. Res. Council 1971 47 p refs Supersedes RAE-TR-68114; ARC-31322

(ARC-R/M-3661; RAE-TR-68114; ARC-31322) Avail: NTIS; HMSO: £1.15; PHI: $4.90

Pressure distribution was measured at one wing section and along the wing-body junction of a half model. The wing was from STAC 11 section (12% thick normal to the leading edge and of rooftop, upper surface design, pressure distribution). The chord Reynolds numbers were from 1.4 to 5.7 million. At high Reynolds number, the wing pressure correlates fairly well, based on conditions normal to the leading edge, with those on the same model with 60 deg sweep, and two dimensional section results with small differences leading to an increase in pressure drag. Author (ESRO)

N72-15950# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN EXPERIMENTAL INVESTIGATION OF THE EFFECT OF THICKNESS ON THE SUBSONIC LONGITUDINAL STABILITY CHARACTERISTICS OF DELTA WINGS OF 70 DEG SWEEP-BACK

D. A. Kirby and D. L. I. Kirkpatrick London Aeron. Res. Council 1971 43 p Supersedes RAE-TR-69256; ARC-32156

(ARC-R/M-3673; RAE-TR-69256; ARC-32156) Avail: NTIS; HMSO: £1.50; PHI: $5.80

Measurements of lift, drag and pitching moment were made on five delta wing models to investigate the effects of thickness on the subsonic longitudinal characteristics of the 70 deg delta planform. For four of the wings the form of the thickness distribution was the same with the maximum thickness/chord ratios equal to 4, 8, 12 and 16 per cent respectively, but for the fifth wing a change in the type of thickness distribution was made while retaining the overall maximum thickness/chord ratio at 4 per cent. The results show that increase of thickness gives rise to losses in lift, reductions in lift-dependent drag and improvements in longitudinal stability. Author (ESRO)

N72-15951# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN IMPROVED TECHNIQUE OF STABILITY TESTING IN FREE FLIGHT AT TRANSONIC SPEEDS, APPLIED TO A NON-LIFTING SLENDER WING

A. P. Waterfall London Aeron. Res. Council 1971 43 p refs Supersedes RAE-TR-69239; ARC-32058

(ARC-CP-1174; RAE-TR-69239; ARC-32058) Avail: NTIS; HMSO: 60p; PHI: $2.55

It was found it is possible to fly slender wing models at zero lift on such a trajectory that the terminal velocity is close to Mach 1. This makes it possible to measure the stability at slowly varying transonic speeds and to obtain much more reliable results than previously obtained. The methods and interim results are presented. Author (ESRO)

N72-15952# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.
THEORETICAL PRESSURE DISTRIBUTIONS ON FOUR SIMPLE WING SHAPES FOR A RANGE OF SUPERSONIC FLOW CONDITIONS
J. Pike London Aeron. Res. Council 1971 49 p refs Supersedes RAE-TR-71064; ARC-33040
(ARC-CP-1178; RAE-TR-70064; ARC-33040) Avail: NTIS; HMSO: £0.70; PHI: $2.95

Pressure distributions are presented for four conical wing shapes with attached shock waves at their leading edges. The influence on the pressure distribution of wing incidence, free stream Mach number or ratio of specific heats is demonstrated. Some pressure distributions over the upper surface are also presented, assuming an isentropic expansion at the leading edge. Author (ESRO)

N72-15953# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
PLANE FLAT PLATE AT INCIDENCE IN SUPERSONIC FLOW
R. D. Archer Jul. 1971 15 p refs Sponsored by Sci. Res. Council
(IC-AERO-71-19) Avail: NTIS

A scheme is presented for solving the inviscid perfect gas flow field behind the detached shock wave in front of a flat plate at arbitary incidence using the method of integral relations in the one strip mode. Simplifications consequent upon the use of this mode allow for direct determination of the stagnation point and also require only a single integration pass to solve for the flow field on each side of the stagnation streamline up to the sharp corners. Author (ESRO)

N72-15954# ARO, Inc., Arnold Air Force Station, Tenn.
INVESTIGATION OF THE AEROELASTIC STABILITY OF THIN CYLINDRICAL SHELLS AT SUBSONIC MACH NUMBERS Final Report
Warren E. White AEDC Nov. 1971 33 p refs
(ARO Proj. PB0189; Task-01)
(AD-732291; ARO-PWT-TR-71-127; AEDC-TR-71-173) Avail: NTIS CSCL 01/3

Boundary-layer and static-pressure data were obtained over a rigid pressure shell at Mach numbers from 0.6 to 0.9 and Reynolds numbers per foot from 300,000 to 5,300,000. These data were obtained with and without the addition of air injected into the boundary layer through a circular slot upstream of the test shell. Static aeroelastic characteristics of thin cylindrical shells were obtained at Mach number 0.9 without the use of boundary-layer control and without shell axial-force loading. An aeroelastic buckling failure was induced on all three shells by reducing the cavity pressure. Flutter of the shell was not encountered during the test. Author (GRA)

N72-15955# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
HYPERSONIC FLOW OF A REAL GAS ON THE WINDWARD SIDE OF A DELTA WING Technical Report, Jun. - Nov. 1970
B. E. Pearce 19 Apr. 1971 56 p refs
(Contract F04701-70-C-0059)
(AD-731763; TR-0059(6770-03)-1; SAMSO-TR-71-233) Avail: NTIS CSCL 01/3

The inviscid flow on the windward side of a flat, sharp-edged delta wing is studied for orbital entry at angles of attack near maximum lift. The solutions are numerical and use the one-strip approximation in the method of integral relations. Properties at the wing surface are given for air in thermodynamic equilibrium for angles of attack of 50 and 60 deg and sweep angles of 70, 75, and 80 deg. These solutions are used to illustrate the cross-flow at the wing surface and are shown to agree with those for a perfect gas with an appropriately chosen, constant effective specific heat ratio. Additional solutions for a perfect gas are given for angles of attack between 30 and 70 deg. Surface pressures at the centerline are shown to be accurately approximated by Newtonian theory or by those pressures on a circular cone with the same surface inclination for sweep angles greater than 75 deg. The cross-flow velocity gradient at the centerline is found to be different from that on an equivalent circular disk. It is demonstrated that the solution for a two-dimensional, flat-faced body is a fair approximation of that obtained for a delta wing with large sweep. Author (GRA)

N72-15956# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
INVESTIGATION OF UNSTEADY AERODYNAMIC FLOWS OVER SPHERES AND DISKS Final Report, 19 May 1965 - 31 Aug. 1971
William W. Willmarth 31 Aug. 1971 4 p
(Contract DAHC04-68-C-0027; Grant DA-ARO(D)-31-124-G711; DA Proj. 200-611-02-B-33-G)
(AD-731862; AROD-5590-6-E) Avail: NTIS CSCL 20/4

The report summarizes the results and conclusions reached in an experimental study of the nature of the unsteady flow about bluff bodies. The flows studied included the flow about a sphere, a disk with face normal to the flow, and an autorotating two-dimensional airfoil. The studies included flow visualization, measurements of unsteady forces and moments, the development of a low Reynolds number towing tank with air bearing carriage and detailed studies of the unsteady inviscid flow field generated by shedding of wake vorticity. Author (GRA)

N72-15957# Royal Inst. of Tech., Stockholm (Sweden). Div. of Aeronautics.
ON THE INDUCED DRAG OF THIN PLANE DELTA WINGS. AN EXPERIMENTAL STUDY OF THE SPANWISE DISTRIBUTION OF THE LEADING EDGE FORCES AT LOW SPEEDS
Sven-Olof Ridder May 1971 58 p refs
(PB-202358; KTH-AERO-TN-57) Avail: NTIS CSCL 01C

Three 60 deg delta wings of identical planform, but with different leading edge radius spanwise distributions have had their induced drag characteristics investigated in a low speed wind tunnel. The spanwise distribution of the local leading edge forces has also been measured by means of a separate leading edge panel element mounted on a sensitive strain gage balance. Author (GRA)

N72-16686# New York Univ., N.Y. Aerospace Lab.
REVIEW OF THE CONCLUSIONS OF THE AGARD AD HOC COMMITTEE ON ENGINE AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS
Antonio Ferri *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 10 p (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16687# National Aerospace Lab., Amsterdam (Netherlands).
INLETS-AIRPLANE TESTING IN TRANSONIC WIND TUNNELS
F. Jaarsma *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16688# Naval Postgraduate School, Monterey, Calif.
NOZZLE AND EXHAUST TESTING IN TRANSONIC FLIGHT REGIME
Allen E. Fuhs *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 32 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16689# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROBLEMS OF MEASUREMENT ON MODEL OF THE

THRUST OF A SUPERSONIC AIRCRAFT AFTER-BODY STANDARD NOZZLES
Bernard Masure *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16691# National Gas Turbine Establishment, Farnborough (England).
MEASUREMENT FULL-SCALE OF PROPELLING NOZZLE PERFORMANCE IN AN ATTITUDE TEST FACILITY
J. C. Ascough *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16695# Motoren-Und Turbinen-Union Muenchen G.m.b.H. (West Germany).
AERODYNAMICS OF THRUST REVERSER DESIGN
W. J. Lewis (Rolls-Royce, Ltd., Bristol, Engl.) and H. Prechter *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 11 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16702# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
FLOW DISTORTION AND PERFORMANCE MEASUREMENTS ON A 12 INCH FAN-IN-WING MODEL FOR A RANGE OF FORWARD SPEEDS AND ANGLE OF ATTACK SETTINGS
Uwe W. Schaub and Robert W. Bassett *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 13 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16708# British Aircraft Corp., Preston (England).
JET EFFECTS ON BOATTAIL PRESSURE DRAG AT SUPERSONIC SPEEDS
J. A. P. Stoddart *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 11 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-15967# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
ON THE DRAG OF PARACHUTES
H.-D. Melzig *In its* Flight Mech. 1971 p 39-56 refs In GERMAN; ENGLISH summary (See N72-15963 07-02)
Avail: NTIS; DFVLR, Porz: 14,80 DM

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-15958# Advisory Group for Aerospace Research and Development, Paris (France).
OPTIMALITY CRITERIA IN STRUCTURAL DESIGN
W. Prager (Brown Univ.) Dec. 1971 16 p refs
(AGARD-R-589-71) Avail: NTIS

The derivation of optimality conditions from extremum principles of structural theory is reviewed, with special emphasis on conditions for global optimality. Following a brief introduction, the optimal design of sandwich structures is discussed for a single behavioral constraint and for multiple constraints. Structural elements with solid sections are dealt with in a separate section. In addition, a three-dimensional problem is investigated that includes many problems of optimal structural design as special cases. A final section presents the previously considered optimality criteria in a unified way that frequently suggests the form of optimality conditions in new situations. Author

N72-15959*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXTERNALLY-BLOWN-FLAP NOISE
Robert G. Dorsch, Walter J. Kreim, and William A. Olsen [1972] 19 p refs Presented at 10th Aerospace Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972; Sponsored by AIAA (NASA-TM-X-67991; E-6737) Avail: NTIS CSCL 01B

Noise data were obtained with a large externally blown flap model. A fan-jet engine exhaust was simulated by a 1/2-scale bypass nozzle supplied by pressurized air. The nozzle was pylon mounted on a wing section having a double-slotted flap for lift augmentation. Noise radiation patterns and spectra were obtained for nozzle exhaust velocities between 400 and 1150 ft/sec. The blown flap noise data are in good agreement with previous small model results extrapolated to test conditions by Strouhal scaling. The results indicate that blown flap noise must be suppressed to meet STOL aircraft noise goals. Author

N72-15960*# Virginia Univ., Charlottesville. Div. of Aerospace Engineering and Engineering Physics.
A PRELIMINARY STUDY OF CONTAINMENT CONCEPTS FOR AIRCRAFT LANDING ON ELEVATED STOL-PORTS
John Kenneth Haviland Oct. 1971 47 p refs
(Grant NGL-47-005-014)
(NASA-CR-125544; AEEP-4068-101-71U) Avail: NTIS CSCL 01E

A preliminary study of containment systems for aircraft landing on elevated STOL-ports was conducted as part of an overall study of human acceptance problems associated with STOL operations. The study included a survey and feasibility study of different concepts and a computer analysis of four arrestment systems. The principal conclusion was that a system referred to as the FAA system appears to offer the greatest promise. In this system, standard arresting gear cables are stretched across the roof-top, at roughly 100-foot intervals, but are shielded over the 100-foot-wide primary landing strip. Thus a pilot can land with an arresting hook down, but will not contact the cable unless he swerves off the landing strip, either because he has made a bad landing, or because his landing gear has failed. It was also noted that a suitable curb or guard rail should be developed. Presently available arresting gears and nylon net barriers were considered satisfactory for the overshoot problem. Author

N72-15961# Royal Aircraft Establishment, Farnborough (England).
RIDING QUALITIES OF AIRCRAFT
Jiro Koo Oct. 1971 24 p refs Transl. into ENGLISH from Natl. Aerospace Lab., Japan, report TW-181, Jun. 1970
(RAE-Lib-Trans-1605; BR-27696; UDC-629.1.073; UDC-629.735.017.2; TM-181) Avail: NTIS

The riding qualities of aircraft are investigated in comparison with other vehicles such as train, automobile and ship. The riding discomfort caused by mechanical vibration and swing motion is discussed. Passenger Rating is newly proposed by the author to classify the aircraft riding qualities from the standpoint of passenger comfort. Author

N72-15962# Boeing Scientific Research Labs., Seattle, Wash. Transportation Systems Research Lab.
A THEORETICAL MODEL FOR THE HEATING OF AN AIRPLANE WING FROM A LIGHTNING DISCHARGE
F. Edward Ehlers and Donald F. Winter Oct. 1971 25 p refs

(D180-14190-1) Avail: NTIS

The temperature response of a metal plate to a steady electric current input on its exterior surface was studied to determine the hazards of possible damage to aircraft structures by lightning. Based on experiments using cylindrical cathode with a blunted conical tip, normally directed toward a flat plate (anode) which was used to generate high intensity electric arcs, the solution of the heat equation was found for a Gaussian distribution of noraml heat flux. The analysis was used to find the maximum temperature on the insulated side of the plate on the arc axis for various total currents and pulse times. The results are in good agreement with those of Kofoid. F.O.S.

N72-15963# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

[FLIGHT MECHANICS] [FLUGMECHANIK]

1971 77 p refs In GERMAN; ENGLISH summaries Proc. of a DFVLR Conf. held at Brunswick, 21 Apr. 1971

(DLR-MITT-71-14) Avail: NTIS; DFVLR, Porz: 14,80 DM

Common flight mechanical aspects in aero- and astronautics, units and values in flight mechanics, and flight dynamics of V/STOL aircraft are discussed, including stability, noise, and ground effect. For individual titles, see N72-15964 through N72-15969.

N72-15964# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

FLIGHT MECHANICAL PROBLEMS OF THE V/STOL TECHNIQUE

K. Wilhelm *In its* Flight Mech. 1971 p 7-18 refs In GERMAN; ENGLISH summary (See N72-15963 07-02)

Avail: NTIS; DFVLR, Porz: 14,80 DM

Problems of STOL performances and flying qualities are discussed, taking into account the take-off distance requirements. The main problems arise from the installation of additional engine power required for vertical take-off, e.g. high fuel consumption, noise generation, as well as thermic and aerodynamic effects. The influence of aerodynamic interference on the dynamics of VTOL aircraft during transition are also studied. Author (ESRO)

N72-15965# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

SOME COMMON ASPECTS OF FLIGHT MECHANICS IN AVIATION AND SPACE FLIGHT [UEBER GEMEINSAME ASPEKTE DER FLUGMECHANIK IN DER RAUM- UND LUFTFAHRT]

E. A. Bockemueller *In its* Flight Mech. 1971 p 19-30 refs In GERMAN; ENGLISH summary (See N72-15963 07-02)

Avail: NTIS; DFVLR, Porz: 14,80 DM

Aspects of flight mechanics of airplanes and reentry vehicles derived by a unified mathematical treatment are discussed. By introduction of suitable variables, a special form of equations of motion is applied to some problems of longitudinal motion of airplanes and atmospheric entry. Author (ESRO)

N72-15966# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

PROGRAMMING OF A SIMULATION MODEL FOR EVALUATING THE RELIABILITY OF TECHNICAL SYSTEMS c08

F. Hammelrath *In its* Flight Mech. 1971 p 31-38 In GERMAN; ENGLISH summary (See N72-15963 07-02)

Avail: NTIS; DFVLR, Porz: 14,80 DM

A programming method is described furnishing relatively quick space saving programs at a modest expenditure of programming and modest error possibilities. Appropriate organization techniques which are prepared in a special preliminary program are used. It is possible to carrry out various error controls. Author (ESRO)

N72-15967# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

ON THE DRAG OF PARACHUTES c01

H.-D. Melzig *In its* Flight Mech. 1971 p 39-56 refs In GERMAN; ENGLISH summary (See N72-15963 07-02)

Avail: NTIS; DFVLR, Porz: 14,80 DM

The drag coefficient of parachutes from Mach number up to 4.0 and Reynolds number up to 10 to 7th power is shown to be dependent on forebody, distance behind forebody, porosity, and parachute shape. Author (ESRO)

N72-15968# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

VALUES AND UNITS IN FLIGHT DYNAMICS c14

E. Mewes *In its* Flight Mech. 1971 p 57-67 refs In GERMAN; ENGLISH summary (See N72-15963 07-02)

Avail: NTIS; DFVLR, Porz: 14,80 DM

The International System of Units and the legal units are presented. It is necessary to distinguish between quantities of equal physical dimensions, e.g. gravitational force and apparent weight force. Author (ESRO)

N72-15969# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).

FUTURE WORK IN THE FIELD OF AIRCRAFT FLIGHT MECHANICS [ZUKUENFTIGE AUFGABEN DER FLUGMECHANIK DES FLUGZEUGS]

P. Hamel *In its* Flight Mech. 1971 p 69-76 In GERMAN (See N72-15963 07-02)

Avail: NTIS; DFVLR, Porz: 14,80 DM

Three main aspects of research are discussed: noise reduction, particularly at take off and landing; the use of an HBF 320 Hansa jet as a flying simulator and description of the test program; and the development of a gust moderator. ESRO

N72-15970# Royal Aircraft Establishment, Farnborough (England). Aerodynamics Dept.

AN APPLICATION OF THE RAE WIND TUNNEL FLIGHT DYNAMICS SIMULATOR TO THE LOW SPEED DYNAMICS OF A SLENDER DELTA AIRCRAFT (HP 115)

D. W. Partridge and B. E. Pecover London Aeron. Res. Council 1971 40 p refs Supersedes RAE-TR-69168; ARC-31779 (ARC-R/M-3669; RAE-TR-69168; ARC-31779) Avail: NTIS; HMSO: £1.45; PHI: $5.80

The wind-tunnel/flight dynamics simulator was applied to a limited study of the dynamic response at low speeds of the Handley-Page HP 115 aircraft. Motions with six degrees of freedom were simulated. The technique provides full representation of the nonlinearities in the aerodynamic force and moment contributions due to translational velocity components. Good qualitative agreement with flight tests results was achieved. The amplitude damping characteristics of the Dutch roll oscillatory motion appear to be largely dependent on the translational velocities. Author (ESRO)

N72-15971# Royal Aircraft Establishment, Bedford (England). Aero Flight Dept.

A SIMULATION OF THE LOW SPEED HANDLING OF THE BAC 221 SLENDER-WING RESEARCH AIRCRAFT

T. Wilcock London Aeron. Res. Council 1971 45 p refs Supersedes RAE-TR-69257; ARC-32262 (RAE-TR-69257; ARC-R/M-3670; ARC-32262) Avail: NTIS; HMSO: £1.65; PHI: $6.75

A pilotad flight simulator study of the low speed handling of the BAC 221 slender wing research aircraft was performed for validation of the simulation of slender wing supersonic transport aircraft. The lateral representation of the aircraft was satisfactory, and lateral control problems experienced on the real aircraft at high angles of incidence were reproduced on the simulator and investigated in more detail than would be practicable in flight. There were several discrepancies in the longitudinal characteristics of the simulation, some of which can be attributed to inadequate

representation of visual cues: satisfactory explanation of other discrepancies was not obtained but further simulation may resolve these problems. Sidestep maneuvers and crosswind landings were studied, and the overall quality of the simulation is discussed in relation to previous supersonic transport aircraft simulations. Author (ESRO)

N72-15972# Royal Aircraft Establishment, Bedford (England). Aerodynamics Dept.

LOW-SPEED WIND-TUNNEL MEASUREMENTS OF THE OSCILLATORY LATERAL AERODYNAMIC DERIVATIVES OF A BAC 221 MODEL AND COMPARISON OF RESULTS WITH SIMILAR CONCORDE AND HP 115 DATA

C. O. OLeary London Aeron. Res. Council 1971 24 p refs Supersedes RAE-TR-70095; ARC-32314
(RAE-TR-70095; ARC-R/M-3671; ARC-32314) Avail: NTIS; HMSO: £0.85; PHI: $3.55

Oscillatory tests for measuring a complete set of low speed lateral derivatives for the BAC 221 slender ogee-wing research aircraft, are described. The tests cover the angle of attack range from 0 to 26 deg and, at some angles of attack, measurements are also made at sideslip angles of + or - 5 deg. Comparsion of the BAC 221 results with Concorde and HP 115 data shows that derivatives due to rate of roll are similar, the translational yawing moment derivative, (n sub v) and particularly the roll derivative (n sub p + n sub v sin alpha) increase markedly with angle of attack for the HP 115, but not for Concorde or BAC 221. ESRO

N72-15973# Royal Aircraft Establishment, Bedford (England). Aero Flight Dept.

POSSIBLE LOSSES IN AIRSPEED DURING TURNING MANOEUVRES IN GUSTY AIR

W. J. G. Pinsker and J. G. Jones Aeron. Res. Council London 1971 33 p refs Supersedes RAE-TR-70021; ARC-32211
(ARC-R/M-3672; RAE-TR-70021; ARC-32211) Avail: NTIS; HMSO: £1.20; PHI: $4.90

It is shown that when performing turning maneuvers in turbulent air, it is possible for an aircraft to suffer quasi-permanent losses (or gains) in airspeed which persist even when the turbulence has ceased. Moreover, these speed changes can be substantially larger than the magnitude of the gust velocities responsible for their generation. Neither of these effects occur in rectilinear flight. This mechanism should be considered in the formulation of airworthiness requirements, and in the conduct of flying involving maneuvering at low altitude and low airspeed. ESRO

N72-15974# Aircraft Research Association, Ltd., Bedford (England).

RESULTS OF A SERIES OF WIND TUNNEL MODEL BREAKDOWN TESTS ON THE TRIDENT 1 AIRCRAFT AND A COMPARISON WITH DRAG ESTIMATES AND FULL SCALE FLIGHT DATA

J. I. Simper and P. G. Hutton London Aeron. Res. Council 1971 84 p refs Supersedes ARC-32252; ARA-14
(ARC-CP-1170; ARC-32252; ARA-14) Avail: NTIS; HMSO: £1.10; PHI: $4.30

Wind tunnel measurements were made and compared with estimates of flight data for 1:18.86 scale model of Trident 1. Measured and estimated drags in general agree well except measured side nacelle drag increment. The general level of agreement between flight and wind tunnel results is within + or - 3% but is as much as 6% for low Mach numbers, probably because the propelling nozzles were unchoked. If the wind tunnel data are corrected to flight Reynolds numbers using the Prandtl-Schlichting relationship, the general level of the wind tunnel results is between 0 and 5% below the measured flight data. Appendices give details of corrections applied to wind tunnel data and tables showing the method of drag estimation. Author (ESRO)

N72-15975# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

ACHIEVEMENTS IN RECORDING AND ANALYSIS OF CIVIL AIRCRAFT OPERATIONS 1962-1969 Civil Aircraft Airworthiness Data Recording Programme

E. Marjorie Owen London Aeron. Res. Council 1971 54 p refs Supersedes RAE-TR-71034; ARC-33038
(RAE-TR-71034; ARC-CP-1181; ARC-33038) Avail: NTIS; HMSO: £0.75; PHI: $3.15

Analogue, continuous trace, and multi-parameter records of airworthiness data, representing more than 65000 flying hours, were taken from jet transport aircraft in regular airline service from 1962 to 1969. In Phase 1 (1962 to 1965) data were recorded on aircraft well proved in service; in Phase 2 (1966 to 1969) newer aircraft were instrumented and the records were augmented by additional parameters chiefly directed to obtaining more detailed landing data. More parameters were recorded than in any previous operational research program and much valuable information was acquired in the fields, among others, of airworthiness, flying hazards, operating practices (including autoland) and meteorology, and of assistance for accident investigations. The success of the program depended on close co-operation between representatives of ARB, BOAC, BEA, CI Data Centre Ltd., RAE and a number of other organizations. The work undertaken and the benefits derived by each organization, and by others using CAADRP data, are described. No plan is being made to acquire further data from specially installed analogue trace recorders. The need for new data has not abated, but further information is being and will be taken from digital versions of the mandatory recorders carried by all UK aircraft. Author (ESRO)

N72-15976# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

HARD LANDINGS ENCOUNTERED BY SUBSONIC CIVIL JET AIRCRAFT Civil Aircraft Airworthiness Data Recording Programme

G. B. Hutton London Aeron. Res. Council 1971 104 p refs Supersedes RAE-TR-70187; ARC-33031
(RAE-TR-70187; ARC-CP-1182; ARC-33031) Avail: NTIS; HMSO: £ 1.35; PHI: $5.45

A selection of events is described which involved hard landing occurring on two types of aircraft during the period December 1965 to October 1969. For this purpose a number of jet aircraft in normal airline service were fitted with recorders producing continuous trace records of 14 parameters. Throughout the recording period, representing 11462 scheduled airline flights, the records were searched for unusual occurrences, and each one studied to determine its nature and, where possible, factors contributing to its cause. The event descriptions include comments, most of which mention contributory causes of the hard landings. A particular study is made of the normal center of gravity acceleration at touchdown and of aircraft maneuvers during the flare. It is pointed out that all the hard landings followed abnormal flare maneuvers. ESRO

N72-15977# Wyle Labs., Inc., Rockville, Md. Payne Div.

DEVELOPMENT OF A DYNAMIC ANALOG ANTHROPOMORPHIC DUMMY FOR AIRCRAFT ESCAPE SYSTEM TESTING Final Report, 1 Jul. 1968 - 24 Feb. 1971

Peter R. Payne and Edward G. U. Band Wright-Patterson AFB, Ohio AMRL Aug. 1971 65 p refs
(Contract F33615-68-C-1731; AF Proj. 7231; Task-7231-01)
(AD-730634; WR-71-15; AMRL-TR-71-10;
Working-Paper-59103-1) Avail: NTIS CSCL 01/3

Development and operational tests of aircraft escape systems require the use of anthropomorphic dummies which simulate both the dynamic influence of the occupant on the escape system trajectory and the dynamic response of the occupant to the escape system accelerations. The report sets forth the criteria, design features, manufacturing techniques and materials used in the development of a unique anthropomorphic dummy. Author (GRA)

N72-15978# Wyle Labs., Inc., Rockville, Md. Payne Div.
THE DYNAMICS OF AN EJECTION SEAT CATAPULT WITH A LIVE LOAD Final Report, 1 Mar. 1970 - 15 Apr. 1971
Edward G. U. Band Wright-Patterson AFB, Ohio AMRL Aug. 1971 30 p refs
(Contract F33615-70-C-1420; AF Proj. 7231; Task-7231-01)
(AD-730635; WR-71-14; AMRL-TR-71-18; Working-Paper-59111-14) Avail: NTIS CSCL 01/3

The report is aimed towards determining the effects on catapult performance of using it to propel a live load. The report describes how an analytical model is built up using a previously developed lumped parameter representation of the human body and ejection seat together with a simple direct stroking catapult. Using this catapult, which is characterized by a sinusoidal type development of propulsive force, the difference between the live load and an equivalent rigid load is, in fact, rather small. The importance of the work described in the report is considered to be rather in the development of the model, which can be used for a wide range of similar problems, than in the results of the small number of problems tested. Author (GRA)

N72-15979# Pereira (William L.) Associates, Corona del Mar, Calif.
WORKBOOK, NATIONAL AVIATION CONCEPT PLAN FOR THE FEDERAL AVIATION ADMINISTRATION Final Report
17 Sep. 1971 210 p refs Revised
(Contract DOT-FA71WA-2590; WLPA Proj. 7114)
(AD-731858) Avail: NTIS CSCL 01/2

Transportation has played a vital role in the process of urbanization. This study examines this role with specific attention to the air mode. Air transportation benefits impact are described and reviewed. Author (GRA)

N72-15980# Bendix Corp., Teterboro, N.J. Flight Systems Lab.
EXPERIMENTAL DISPLAY REFERENCED FLIGHT CONTROL SYSTEM WITH PILOT CONTROL FORCE STEERING Final Technical Report
John T. Sliney Sep. 1971 95 p refs
(Contract F33615-69-C-1468; AF Proj. 8226; Task-822607)
(AD-731805; Rept-7211-356; AFFDL-TR-71-90) Avail: NTIS CSCL 01/3

The report describes an experimental flight control system that incorporates commands from the standard cockpit displays, aircraft control from a basic displacement type attitude referenced autopilot, and pilot supervision of control performance and command insertion via a cruise/approach mode force wheel steering system. For the purpose of flight research, a standard FD109 Flight Director was coupled to a commercial PB-20D Flight Control System via a program developed coupling box that provides the displacement, integration, signal switching, force wheel steering summation, and logic circuitry for interfacing the production autopilot and flight director systems. The system has been used, as illustrated with flight recordings in the text, for automatic landings and go-around, as well as on GCA type approaches through pilot control inputs in response to ground controller directions. Author (GRA)

N72-15981# Bendix Corp., Teterboro, N.J. Navigation and Control Div.
A PITCH AND HEADING COMMAND TECHNIQUE FOR CONTROL/DISPLAY SYSTEMS Final Technical Report, Jul. 1967 - Aug. 1969
John R. Woloshen and Richard V. Wible (AFFDL) May 1971 21 p
(Contracts F33615-67-C-1930; F33615-67-C-1468; AF Proj. 8226; Task-822607)
(731804; AFFDL-TR-71-59) Avail: NTIS CSCL 01/3

The report presents the engineering design of a data insertion technique for remotely operating heading select and attitude reference features of a control/display system from a centrally located control console, the aircraft control wheel. The control logic presented and the location of the controllers enables the pilot to conveniently and precisely insert heading and attitude data into the control/display system. The processed commands emanating from this data can be executed either manually or automatically. This approach to flight control data insertion frees the pilot from the physical activity associated with other insertion methods. Author (GRA)

N72-15982# Lockheed-California Co., Burbank.
ADVANCED ANTI-TORQUE CONCEPTS STUDY Final Report
J. L. Velazquez Ft. Eustis, Va. USAAMRDL Aug. 1971 205 p refs
(Contract DAAJ02-70-C-0043; DA Proj. 1F1-62203-A-143)
(AD-731493; LR-24295; USAAMRDL-TR-71-44) Avail: NTIS CSCL 01/3

A design study has been conducted by the Lockheed-California Company on advanced antitorque concepts intended to replace tail rotors on conventional single-main-rotor/tail-rotor helicopters. The principal design objectives were to reduce hazard to ground personnel and to reduce vulnerability of helicopters to terrain-contact damage. Secondary objectives were reduced vulnerability to small-arms fire and improvements in dynamic, reliability, maintainability and noise characteristics. Two systems were selected from a broad literature search and subsequent design studies. The first concept is based on a main-rotor-driven axial flow fan internally mounted in the aft fuselage delivering air under pressure to a variable geometry louvered exit for antitorque and/or forward-flight propulsion thrust. The second concept employs a main-rotor-driven ducted fan installed in a central pylon supporting a twin-fin empennage. Results of preliminary design studies applying these concepts to an existing Lockheed Model 286 helicopter are presented in this report, including performance and weight data. Improvements over the research vehicle that could result from applying these concepts to a totally new vehicle, using current state-of-the-art design technology, are also discussed. Author (GRA)

N72-15983# Assistant Secretary of the Navy (Installations and Logistics), Washington, D.C.
NAVY F-14 AIRCRAFT (BEING CONSTRUCTED BY GRUMMAN AEROSPACE CORPORATION) Final Environmental Impact Statement
10 Sep. 1971 43 p Revised
(PB-199851F) Avail: NTIS CSCL 01C

A summary of environmental impact and adverse environmental effects caused by operation of the F-14 aircraft are given. Effects include the following. Air pollution is caused by exhaust emissions and the aircraft produces noise while in flight. Also the possiblity of environmental contamination if a crash occurs is addressed. No intolerable environmental effects are foreseen and effects are incorporated in the development program to minimize the impact. An alternative considered is the continued use of the F-4J fighter aircraft which for defense purposes is considered an inferior weapons system to the threat proposed for the mid-70 period. Author (GRA)

N72-15984# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA, US GENERAL AVIATION CALENDAR YEAR 1969
28 Apr. 1971 177 p
(PB-201841; NTSB-ARG-71-1) Avail: NTIS CSCL 01B

The publication contains statistical information compiled from reports of 4757 general aviation accidents that occurred during the calendar year 1969. Included in the total number of accidents are 45 collisions between aircraft. By coding each aircraft involved in the collisions, an additional 45 records are produced, bringing the total accidents records to 4812. This figure reflects the true number of pilots and aircraft involved in the accidents. Author (GRA)

N72-15985# Human Engineering Labs., Aberdeen Proving Ground, Md.
BASELINE NOISE MEASUREMENTS OF THE OH-58A HELICOPTER
Donald L. Lince Apr. 1971 72 p refs
(AD-731467; HEL-TN-3-71) Avail: NTIS CSCL 20/1

Sound measurements were taken in the OH-58A (Kiowa) Helicopter under conditions of maximum performance take off and climb, normal cruise, descent and hover both with and without soundproofing installed. Measurements were taken of the noise produced by firing the XM27E1 minigun system. Intelligibility tests of the intercom system and one radio receiver were carried out. Results are presented and compared to Human Engineering Laboratories Standard S-1-63B. Hearing hazard presented by weapon firing is discussed. Author (GRA)

N72-16778 Lord Mfg. Co., Erie, Pa.
IMPROVING RELIABILITY AND ELIMINATING MAINTENANCE WITH ELASTOMERIC DAMPERS FOR ROTOR SYSTEMS
J. L. Potter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 141-149 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16817 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE NOISE ENVIRONMENT OF A DEFLECTED-JET VTOL AIRCRAFT
F. L. McFarland and D. L. Smith *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 161-171 ref (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16821 Frankford Arsenal, Philadelphia, Pa.
STRUCTURAL VIBRATIONS IN THE BELL AH-1G HELICOPTER DURING WEAPON FIRING
R. J. Holland (Kinetic Systems, Inc., Boston, Mass.), D. Marcus, and J. Wiland *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 195-207 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16822 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CHARACTERISTICS OF GUNFIRE INDUCED VIBRATION IN HELICOPTERS
C. E. Thomas and V. C. McIntosh *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 209-219 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16823 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INFLIGHT VIBRATION AND NOISE STUDY OF THREE HELICOPTERS
Phyllis G. Bolds and John T. Ach *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 221-232 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16898*# Duke Univ., Durham, N.C.
DYNAMIC DEFLECTIONS OF MULTI-SPAN GUIDEWAYS UNDER HIGH SPEED, AIR CUSHION VEHICLES
James F. Wilson *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 47-60 refs (See N72-16893 07-32)
(Grant NGL-34-001-005; Contract DOT-FR-00037)
(NASA-CR-125446) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 01B

N72-16854 Bell Helicopter Co., Fort Worth, Tex.
HELICOPTER FUSELAGE VIBRATION RESPONSE ANALYSIS USING THE HYBRID COMPUTER
James D. Cronkhite *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 131-139 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16874 Boeing Co., Philadelphia, Pa.
REDUCTION IN VIBRATION OF THE CH-47C HELICOPTER USING A VARIABLE TUNING VIBRATION ABSORBER
James J. OLeary *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 191-202 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16697# Royal Aircraft Establishment, Bedford (England).
SOME APPLICATIONS OF BOUNDARY-LAYER CONTROL BY BLOWING TO AIR INLETS FOR V/STOL AIRCRAFT
I. McGregor *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 13 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16699# Rolls-Royce, Ltd., Derby (England). Engine Div.
RAPID MIXING NOZZLES FOR V/STOL APPLICATIONS
C. M. Chesters *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 11 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16703# Boeing Co., Seattle, Wash.
THE DESIGN, DEVELOPMENT, AND TESTING OF A SUPERSONIC TRANSPORT INTAKE SYSTEM
E. Tjonneland *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 17 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16704# National Gas Turbine Establishment, Pyestock (England). Engine Test Dept.
FREE-JET TESTS OF A FULL SCALE SUPERSONIC INTAKE/ENGINE COMBINATION
P. F. Ashwood *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 19 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16706# Boeing Co., Seattle, Wash.
CONTROL CONCEPT AND WIND TUNNEL TESTING OF A SUPERSONIC INTAKE CONTROL SYSTEM
H. N. Larsen and R. G. Schweikhardt *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 23 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16710# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SUPERSONIC INLET PERFORMANCE AND DISTORTION DURING MANEUVERING FLIGHT
L. E. Surber and D. J. Stava *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 18 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-15986* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FRANGIBLE ELECTROCHEMICAL CELL Patent
Gerald Halpert, Joseph G. Haynos, and Joseph M. Sherfey, inventors (to NASA) Issued 21 Sep. 1971 7 p Filed 15 May 1968
(NASA-Case-XGS-10010; US-Patent-3,607,401; US-Patent-Appl-SN-729299; US-Patent-Class-136-6; US-Patent-Class-136-133; US-Patent-Class-136-135) Avail: US Patent Office CSCL 10A

A flexible, frangible electrochemical cell and cell package for operation in an atmospheric environment is described. The cell has flexible, frangible electrode plates and an electrolyte containing separators sandwiched between the plates. The electrodes and the separators are secured together by electrically nonconductive fasteners, and each electrode has an expanded metal terminal. The cell housing is a flexible polymeric member having bonded outer seams, some of which are formed directly over the expanded metal terminals which partially protrude from the housing. An additional envelope or outer container may be provided to thermally insulate the cell. Such a container may be made from foamed polymeric material or flexible polymeric sheet filled with insulation. Official Gazette of the U.S. Patent Office

N72-15987*# Heliotek, Sylmar, Calif.
DEVELOPMENT OF LITHIUM DIFFUSED RADIATION RESISTANT SOLAR CELLS, PART 2 Final Report
P. R. Payne and H. Somberg 23 Nov. 1971 55 p refs Prepared for JPL
(Contracts NAS7-100; JPL-95247)
(NASA-CR-125542) Avail: NTIS CSCL 10A

The work performed to investigate the effect of various process parameters on the performance of lithium doped P/N solar cells is described. Effort was concentrated in four main areas: (1) the starting material, (2) the boron diffusion, (3) the lithium diffusion, and (4) the contact system. Investigation of starting material primarily involved comparison of crucible grown silicon (high oxygen content) and Lopex silicon (low oxygen content). In addition, the effect of varying growing parameters of crucible grown silicon on lithium cell output was also examined. The objective of the boron diffusion studies was to obtain a diffusion process which produced high efficiency cells with minimal silicon stressing and could be scaled up to process 100 or more cells per diffusion. Contact studies included investigating sintering of the TiAg contacts and evaluation of the contact integrity. Author

N72-15988*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY PERFORMANCE OF A 4.97-INCH RADIAL TURBINE OPERATING IN A BRAYTON POWER SYSTEM WITH A HELIUM-XENON GAS MIXTURE
Milton J. Leroy, Jr., Lloyd W. Ream, and Joseph S. Curreri Dec. 1971 17 p refs
(NASA-TM-X-67996; E-6744) Avail: NTIS CSCL 10A

The performance characteristics of the Brayton-rotating-unit's 4.97-inch radial turbine were investigated with the turbine part of a power conversion system. The following system parameters were varied: turbine inlet temperature from 1200 to 1600 F, compressor inlet temperature from 60 to 120 F, compressor outlet pressure from 20 to 45 psia, and shaft speed from 90-110 percent of rated speed (36000 rpm). The working fluid of the system was a gas mixture of helium-xenon with a nominal molecular weight of 83.8. Test results indicate that changes in system conditions have little effect on the turbine efficiency. At the design turbine inlet temperature of 1600 F and compressor inlet temperature of 80 F, an average turbine efficiency of 91 percent was obtained. Author

N72-15989*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STEADY-STATE TEMPERATURE DISTRIBUTION WITHIN A BRAYTON ROTATING UNIT OPERATING IN A POWER CONVERSION SYSTEM USING HELIUM-XENON GAS
Roy L. Johnsen, David Namkoong, and Richard A. Edkin Dec. 1971 29 p refs
(NASA-TM-X-67990; E-6736) Avail: NTIS CSCL 10A

The Brayton rotating unit (BRU), consisting of a turbine, an alternator, and a compressor, was tested as part of a Brayton cycle power conversion system over a side range of steady state operating conditions. The working fluid in the system was a mixture of helium-xenon gases. Turbine inlet temperature was varied from 1200 to 1600 F, compressor inlet temperature from 60 to 120 F, compressor discharge pressure from 20 to 45 psia, rotative speed from 32 400 to 39 600 rpm, and alternator liquid-coolant flow rate from 0.01 to 0.27 pound per second. Test results indicated that the BRU internal temperatures were highly sensitive to alternator coolant flow below the design value of 0.12 pound per second but much less so at higher values. The armature winding temperature was not influenced significantly by turbine inlet temperature, but was sensitive, up to 20 F per kVA alternator output, to varying alternator output. When only the rotational speed was changed (+ or - 10% of rated value), the BRU internal temperatures varied directly with the speed. Author

N72-15990*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY PERFORMANCE OF THE BRAYTON 4.25 INCH RADIAL COMPRESSOR OPERATING IN A HELIUM XENON GAS MIXTURE
Armen S. Asadourian, Thomas P. Hecker, and Roman Kruchowy Dec. 1971 34 p refs
(NASA-TM-X-67989; E-6735) Avail: NTIS CSCL 10A

Compressor performance was mapped during the Brayton cycle power system testing. The range of testing included three shaft speeds: the design speed of 36,000 rpm, 10 percent overspeed (39,600 rpm), and 10 percent underspeed (32,400 rpm). A range of compressor inlet temperatures from 60 F to 120 F and discharge pressures from 20 to 45 psia were included. The effects of turbine inlet temperatures (from 1200 F to 1600 F) on the compressor were also studied. The data presented include plots of weight flow, compressor pressure ratio, efficiency, and temperature-rise ratio. Author

N72-15991*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COLD STARTUP AND LOW TEMPERATURE PERFORMANCE OF THE BRAYTON CYCLE ELECTRICAL SUBSYSTEM
James E. Vrancik and Richard C. Bainbridge Dec. 1971 17 p refs
(NASA-TM-X-67995; E-6743) Avail: NTIS CSCL 10A

Cold performance tests and startup tests were conducted on the Brayton-cycle inverter, motor-driven pump, dc supply, speed control with parasitic load resistor and the Brayton control system. These tests were performed with the components in a

vacuum and mounted on coldplates. A temperature range of ±25 to -50 C was used for the tests. No failures occurred, and component performance gave no indication that there would be any problem with the safe operation of the Brayton power generating system. Author

N72-15992*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH-CAPACITY COMPACT VORTEX VALVE FOR INCREASING STABILITY OF SUPERSONIC MIXED-COMPRESSION INLETS
Vernon D. Gebben Washington Feb. 1972 34 p refs
(NASA-TN-D-6662; E-6600) Avail: NTIS CSCL 13K

A special vortex valve was developed for increasing the stability margin of supersonic jet-engine inlets without the use of moving mechanical parts. A compact valve with high flow capacity and with high gain was obtained by using a unique outer wall in the vortex chamber instead of the usual cylindrical shape. The physical features of the valve are described, and the steady pressure-flow characteristics measured on scale models are given. Procedures are provided for adjusting the operating pressure, flow capacity, and gain through systematic changes in geometry. Author

N72-15993*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF WINDAGE-LOSS DATA FOR A LUNDELL ALTERNATOR
Erwin E. Kempke, Jr. and Sol. H. Gorland Washington Feb. 1972 24 p refs
(NASA-TN-D-6650; E-6634) Avail: NTIS CSCL 10A

Viscous torque (windage) of a Lundell-shaped rotor having a major diameter of 20.3 cm (8 in.) rotating within a concentric housing was measured at speeds up to 36,000 rpm. The center cylindrical section of the housing was tested with both a smooth surface and axial slots to simulate alternator winding slots. For concentric cylinders, the range of Reynolds numbers was extended to 70,000. Three radial clearances, 1, 2, and 4 mm (0.04, 0.08, and 0.16in.), corresponding to 1, 2, and 4 percent of the rotor radius, were tested. Author

N72-15994# Los Alamos Scientific Lab., N.Mex.
ELECTROCHEMICAL REDUCTION OF EUROPIUM AT A POROUS CARBON CATHODE WITH FLOWING ELECTROLYTE
E. I. Onstott and C. R. McClenahan 1971 9 p refs Presented at 9th Rare Earth Res. Conf, Blacksburg, Va., 10 Oct. 1971
(LA-DC-12469; Conf-711001-2) Avail: NTIS

EuBr3 electrolytes were electrolyzed between porous carbon electrodes with the electrolyte flowed through the electrodes. Current-voltage curves were obtained under precisely controlled flow conditions with dissolved oxygen removed. Eu-3(+) reduction to Eu-2(+) started at cell potentials greater than about 1.4 volts. At higher cell potentials, limiting current regions were demonstrated, indicating complete formation of Eu-2(+) at the cathode. Relatively high cell potentials were required to obtain quantitative Eu-2(+1) formation when the electrolyte flows were high, and/or when the Eu-3(+) concentrations were high. Eighty-three % of the current could be accounted for by bulk flow of electrolyte to the cathode, and the remaining 17% was attributed to migration effects. The cathode reaction appeared to be reversible in the sense that electron transfer was not rate limiting, but irreversible in the sense that overvoltage was necessary to overcome cell resistance. Author (NSA)

N72-15995# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Electronic Systems Div.
A MODERN SPACECRAFT POWER SYSTEM CONCEPT WITH POWER ADAPTATION, USING A 'MAXIMUM POWER POINT TRACKER'
H. Froehlich and W. Mueller [1970] 20 p refs Sponsored jointly by Bundesmin. fuer Bildung und Wiss. and Ges. fuer Weltraumforsch.
Avail: NTIS

A description is given of spacecraft power system optimization by special power conditioning, incorporating impedance adaptation to the solar array. The gain of power or efficiency by adaptation is based on the fact that the nonlinear I-V characteristics of the array changes its parameters; open circuit voltage as a function of temperature, and shorting current as a function of illumination and degradation. As an example of this principle, the Aeros satellite power system is described and it is shown that power system weight and thermal problems can be reduced. ESRO

N72-15996# Electrical Research Association, Leatherhead (England).
DEVELOPMENT OF INTEGRAL COVERS FOR SILICON SOLAR CELLS Interim Report
G. Brackley and D. W. Satchell Paris ESRO May 1970 44 p refs
(Contract ESTEC-810/69)
(ESRO-CR-16; IR-1) Avail: NTIS

An improved technique for depositing integral protection coatings on silicon solar cells, to replace conventional cover slides mounted individually with adhesives, is considered. A study of available materials led to a preference for cerium-stabilized borosilicate glasses, and from a survey of deposition methods, radio frequency sputtering was found to be the best, since it permits a high deposition rate and wide possibilities in materials. The development and testing of a sputtering apparatus are described. ESRO

N72-15997# Aerospace Corp., El Segundo, Calif.
TRACE66 TRAJECTORY ANALYSIS AND ORBIT DETERMINATION PROGRAM. VOLUME 10: LUNAR GRAVITY ANALYSIS Technical Report, Jul. 1970 - Jul. 1971
W. D. Downs, R. H. Prislin, and D. M. C. Walker 15 Aug. 1971 76 p refs
(Contracts F04701-70-C-0059; F04701-71-C-0172)
(AD-732202; TR-0059(9320)-1-Vol-10;
SAMSO-TR-71-141-Vol-10) Avail: NTIS CSCL 22/3

The TRACE66 Trajectory Analysis and Orbit Determination Program is a general-purpose orbital analysis program. It was written specifically for the CDC 6000 series computers to assist The Aerospace Corporation personnel in the analysis and design of satellite orbits and tracking systems. Volume 10 in its documentation series is a technical reference for the Lunar Gravity Field Analyzer of TRACE66. A comprehensive description is presented of the analysis procedure and of associated techniques used for dynamical determination of lunar gravitational constants and reconstruction of lunar satellite orbits. Author (GRA)

N72-15998# Air Force Academy, Colo. Frank J. Seiler Research Lab.
A LIGHTWEIGHT HIGH ENERGY BATTERY
Armand A. Fannin, Jr., Lowell A. King, and David W. Seegmiller Oct. 1971 12 p refs Presented at the 1971 AFSC Sci. and Eng. Symp., Dayton, Ohio, 5 Oct. 1971
(AF Proj. 7903-00-05)
(AD-732198; SRL-TR-71-0019) Avail: NTIS CSCL 10/3

The characteristics of a newly devised high energy output battery are described. This battery utilizes aluminum and chlorine as the reactive materials. The electrochemical reactions take place in a molten salt electrolyte maintained at 125-200C. The properties of this battery are compared with a list of desired characteristics of high energy batteries, and are contrasted with those of existing conventional batteries and advanced batteries now under development. Studies of the aluminum electrode revealed an unexpectedly high cell voltage arising from concentration differences in the electrolyte. This voltage increment can be added to the voltage expected from the aluminum chlorine cell, and yields a 25 percent increase in theoretical energy output. A model of the electrolyte structure is postulated

which explains the unusually high voltages. This model provides a guide for the prediction of still other electrodes and electrolytes that might be utilized in high energy output batteries.
Author (GRA)

N72-15999# General Dynamics Corp., San Diego, Calif. Electro Dynamic Div.
PP-6148( )/U POWER SUPPLY ADVANCED DEVELOPMENT MODELS Final Report
Edward D. Schmidt Oct. 1971 49 p
(Contract DAAB07-70-C-0054; Task-1H66410-D-53501)
(AD-732325; ECOM-0054-F) Avail: NTIS CSCL 10/2

The report describes design and development work which resulted in the production of three (3) ADM and fifty-two (52) ET/ST models of PP-6148()/U Power Supply. Included is a comprehensive report of performance and environmental test results. The PP-6148()/U Power Supply is a lightweight power supply rated at 14 vdc and 28 vdc at 10 amperes. The supply is intended for universal military usage as an ac- to -dc power source for equipments that are designed to interface directly with a Type I standard battery. Special circuitry and control facilities provide a secondary usage as a battery charger for vented nickel cadmium, and sealed or vented zinc-silver oxide battery systems. Author (GRA)

N72-16000# Army Electronics Command, Fort Monmouth, N.J.
POWER CONDITION AND CONTROL MODULE FOR HYDRAZINE-AIR BATTERY, TYPE 1, PP-6204( )/U
Melvin E. Cannon Jun. 1971 21 p
(Task-1T6-62705-A-053)
(AD-732339; ECOM-3435) Avail: NTIS CSCL 09/5

Military manpack type air battery power sources are presently under development by the US Army Electronics Command. These lightweight, silent, static power sources are needed to operate solid state communication and surveillance equipment and to recharge sealed and vented combat area type nickel-cadmium secondary batteries. The hydrazine-air battery, Type I, PP-6204()/U is a 60 watt system which utilizes two 21 cell stacks in parallel as the raw source of electrical power. A power conditioning and control system reflecting established components, circuits and techniques was applied to a prototype design of the 60 watt hydrazine-air power source. The functional aspects of the power conditioning system were based on a general purpose power source application which imposes the widest range of constraints. The availability of practical power conditioning technology for this much needed power source has been demonstrated. Author (GRA)

N72-16001# Army Electronics Command, Fort Monmouth, N.J. Power Sources Div.
ENGINEERING EVALUATION OF PRIMARY ORGANIC ELECTROLYTE D CELLS
Nicholas T. Wilburn Jul. 1971 30 p
(DA Proj. 1T6-62705-A-053)
(AD-731473; ECOM-3444) Avail: NTIS CSCL 10/3

An engineering evaluation program was conducted on D size primary lithium-organic electrolyte cells. They were evaluated under a variety of conditions to determine feasibility of the system to meet representative sensor and manpack communications requirements, normally met with magnesium or mercury dry batteries. The cells demonstrated good performance capability in terms of energy density, low temperature (-20F) operation, and charge retention following storage at 130F and 160F. Initial voltage delay was found to exist at low temperature or after high temperature storage. Cell conditioning may be required in some cases. Author (GRA)

N72-16002# General Electric Co., Schenectady, N.Y.
ENERGY SYSTEMS FOR IMPLANTABLE CIRCULATORY ASSIST DEVICES Annual Report, 28 Jun. 1968 - 27 Jun. 1969
R. P. Hamlen and E. G. Siwek 15 Jul. 1971 75 p refs
(Contract PH-43-68-1445)
(PB-201936; S-71-1072; PH-43-68-1445-1) Avail: NTIS CSCL 10C

Nickel cadmium batteries with and without signal electrodes were investigated for use as implantable electric energy storage systems. The addition of the signal electrodes, in combination with appropriate charge control circuitry and high charging rates, promises to yield superior performance at the high body temperature. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-16003*# Naval Aerospace Medical Inst., Pensacola, Fla.
THE INFLUENCE OF VISION ON SUSCEPTIBILITY TO ACUTE MOTION SICKNESS STUDIED UNDER QUANTIFIABLE STIMULUS-RESPONSE CONDITIONS
Wihelmus J. Oosterveld, Ashton Graybiel, and D. Bryant Cramer
17 Nov. 1971 8 p refs
(NASA Order L-43518)
(NASA-CR-125546; NAMRL-1149) Avail: NTIS CSCL 06S

Twenty-four healthy men, 22 to 25 years of age, were exposed to stressful accelerations in a rotating room until acute mild motion sickness was elicited. Thirteen subjects in one group were exposed first with eyes open and later with eyes covered; the reverse order was used with the remaining eleven in the other group. The stressful accelerations were generated by requiring the subject to execute 120 standardized head movements at each 1-rpm increase in angular velocity until the desired endpoint was reached. When susceptibility to motion sickness with eyes open and covered is compared, 19 subjects were more susceptible with eyes open, three with eyes covered, and in the remaining two susceptibility was the same. The maximum difference in velocity between trial 1 and 2 was 7 rpm when susceptibility was greater with eyes open and 3 rpm when it was greater with eyes covered; the means, respectively, were 3.2 and 2.0 rpm. Among subjects manifesting greater susceptibility with eyes open than covered the group differences were small, indicating little or no adaptation effects. The findings are discussed mainly on the basis that vision may act also to decrease susceptibility under the stimulus conditions described.
Author

N72-16004# Royal Aircraft Establishment, Farnborough (England).
STUDY OF NOCTURNAL VIGILANCE IN THE HUMAN OPERATOR (PHASE 1). PART 1: EXPERIMENTER PROCEDURE
M. Defayolle, J. P. Dinand, and J. Jacq Sep. 1971 42 p
Transl. into ENGLISH of "Etude de la Vigilance Nocturne chez l'Operateur Human (Premiere Phase). 1: Procedure Experimentale, Centre de Rech. du Service de Sante des Armees, France, report 245/CRSSA/PS
(RAE-Lib-Trans-1607; Rept-245/CRSSA/PS) Avail: NTIS

The sleep-inhibiting effects of certain medicinal products on human performance are examined. These products were administered to a number of subjects who were then called upon to perform various tasks, involving alertness, during the period from 2000 h to 0600 h on each of four nights. Only the tasks given to the subjects and the methods of analysing the results are given here. The tasks covered: (a) measurements of reaction time, (b) tests requiring maintained attention, (c) letter marking tasks (with and without a secondary task), (d) calculation tests, (e) visual detection tasks (with and without a secondary task), and (f) tests of thymic auto-evaluation. In addition, electroencephalograph and electrocardiograph measurements were made throughout the periods of the tests, and these were analysed by frequency spectra and by the extraction of evoked visual potentials. Author

N72-16005*# North Carolina State Univ., Raleigh.
DEVELOPMENT OF A NOISE ANNOYANCE SENSITIVITY SCALE
Howard L. Bregman and Richard G. Pearson Washington NASA Feb. 1972 44 p refs
(Grant NGL-34-002-055)
(NASA-CR-1954) Avail: NTIS CSCL 05E

Examining the problem of noise pollution from the psychological rather than the engineering view, a test of human sensitivity to noise was developed against the criterion of noise annoyance. Test development evolved from a previous study in which biographical, attitudinal, and personality data was collected on a sample of 166 subjects drawn from the adult community of Raleigh. Analysis revealed that only a small subset of the data collected was predictive of noise annoyance. Item analysis yielded 74 predictive items that composed the preliminary noise sensitivity test. This was administered to a sample of 80 adults who later rate the annoyance value of six sounds (equated in terms of peak sound pressure level) presented in a simulated home, living-room environment. A predictive model involving 20 test items was developed using multiple regression techniques, and an item weighting scheme was evaluated. Author

N72-16006*# Techtran Corp., Glen Burnie, Md.
EFFECT OF COMPOSITION OF A GAS MIXTURE ON GROWTH OF BACTERIA ASSIMILATING GASEOUS HYDROCARBONS
Z. S. Smirnova Washington NASA Jan. 1972 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 1, Jan.-Feb. 1970 p 30-37
(Contract NASw-2037)
(NASA-TT-F-14109) Avail: NTIS CSCL 06M

The results of studies of the effect of the composition of a gas mixture on the growth of bacteria oxidizing methane and propane are presented. It was found that the biomass concentration in the medium (all other conditions being equal) is directly proportional to the concentration of hydrocarbon and oxygen in the gaseous mixture. An oxygen concentration of up to 50% in a medium with methane and up to 55% in a medium with propane will not inhibit the growth of bacteria. The degree of utilization of the methane or propane for the construction of cell substance depends on the ratio of hydrocarbon and oxygen. Methane is most effectively utilized by bacteria at a volume ratio between O2 and CH4 equal to 1.5. Propane assimilation takes place most effectively at an O2:C3H8 ratio equal to 3. It is shown that carbon dioxide is required for growth of methane-oxidizing bacteria. The optimum CO2 concentration is between 5 and 10%. A higher concentration of hydrocarbon has an inhibiting effect on the development of gas-oxidizing bacteria. A CO2 concentration above 20% completely suppresses growth. Author

N72-16007*# Techtran Corp., Glen Burnie, Md.
COMMENTS ON EXCESS CALCIUM IN THE BODY
J.-P. Rombauts Washington NASA Feb. 1972 14 p refs Transl. into ENGLISH from the Belgium Rept.
(Contract NASw-2037)
(NASA-TT-F-14155) Avail: NTIS CSCL 06P

The possible ill effects of excess calcium in the body are discussed in connection with clinical observations, together with the importance of proper diet. Author

N72-16008*# Techtran Corp., Glen Burnie, Md.
PATHOGENESIS OF WEIGHTLESSNESS SYNDROME
Ye. A. Kovalenko and P. V. Vasilyev Washington NASA Jan. 1972 23 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Viol. (Moscow), no. 2 1971 p 356-269
(Contract NASw-2037)
(NASA-TT-F-14049) Avail: NTIS CSCL 06S

Under conditions of a prolonged space flight a reorganization of many physiological systems of the organism, such as the analyzers, blood circulation organs, respiration, the stato-kinetic apparatus, and various kinds of metabolism etc., takes place. The pecularities of the character of the organism's reaction to the action of weightlessness permit discerning five stages: (1) transition from super gravitational stress to weightlessness; (2) partial adaptation to weightlessness; (3) gradual increase (cumulation) of the unfavorable effects of weightlessness influence; (4) transition from weightlessness to super gravitational stress and terrestrial gravitation; and (5) residual effects of the weightlessness influence and adaption to terrestrial gravitation. The basic pathegenetic links of the disturbances arising in connection with the influence of weightlessness on the system of analyzers, hydrostatic pressure of the fluids stato-kinetic apparatus, the organism's energetics and metabolism are considered. Author

N72-16009# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
ON A CLASS OF HEREDITARY PROCESSES IN BIOMECHANICS
Kenneth L. Cooke, Nestor Distefano, and Bayesteh Kashef Jan. 1972 23 p refs
(Grant GM-16197-04)
(TR-72-5) Avail: NTIS

The description of biomechanical hereditary processes leads to the study of nonlinear Volterra integral equations. It is shown that under convenient assumptions regarding the nature of the memory of the system approximate equations of evolution of the process can be given in terms of a system of difference-differential equations subject to initial conditions. Alternative formulations are discussed, mainly emphasizing numerical aspects. The identification problem is briefly discussed and some numerical examples, obtained using synthetic data, are presented to exhibit the application and the principal ideas of the method. Author

N72-16010# Sloan-Kettering Inst. for Cancer Research, New York.
BIOLOGICAL AND CLINICAL DOSIMETRY Annual Progress Report, 1 Jul. 1970 - 30 Jun. 1971
John S. Laughlin Jun. 1971 26 p refs
(Contract AT(30-1)-3510)
(NYO-3510-18) Avail: NTIS

Progress is reported for the use of dosimeters in clinical medicine and biological analysis. Data include (1) fabricating tissue equivalent absorbed dose calorimeter for neutrons; (2) determination of the sensitivity of hexahydroxyethyl pararosaniline cyanide radiochromic dosimeter to gamma rays and neutrons; (3) measurements of LET distributions produced by various neutron sources; and (4) measurement of absorbed dose rates with Pilot-B disks. E.H.W.

N72-16011# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ANNUAL REPORT FOR 1970 TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE. VOLUME 2: PHYSICAL SCIENCES. PART 1: ATMOSPHERIC SCIENCES
C. L. Simpson Jun. 1971 178 p refs
(Contract AT(45-1)-1830)
(BNWL-1551-Vol-2-Pt-1) Avail: NTIS

Progress reports covering atmospheric processes as related to the USAEC programs are given. The summaries include scavenging studies, diffusion and turbulence studies, radioisotope as particles and volatiles, and ecological micrometeorology and climatology. E.H.W.

N72-16012# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
BIOLOGICAL ASPECTS OF SKIN IRRADIATION. PART 3: NEW EPIDERMAL THICKNESS MEASUREMENTS AND THEIR IMPORTANCE
J. T. Whitton Apr. 1971 54 p refs
(RD/B/R-1934-Pt-3) Avail: AEC Depository Libraries

A new method for measuring epidermal thickness that is applicable in radiation dosimetry is described. The procedure has

several advantages over conventional techniques since elasticity is accounted for. Quick measurements were made on 214 samples taken from 188 persons by means of a biopsy punch. Epidermal thickness was correlated with sex, age, and body site. The complete detailed results are given and discussed together with simplified adaptations for use in radiation protection. NSA

N72-16013# Human Engineering Labs., Aberdeen Proving Ground, Md.
NOISE AND BLAST: AN ANNOTATED BIBLIOGRAPHY OF RESEARCH PERFORMED AT THE HUMAN ENGINEERING LABORATORIES, 1956 - 1970
Violet J. Confer and Thelma M. Ashley Sep. 1971 28 p refs
(AD-731468) Avail: NTIS CSCL 20/1
The bibliography is an annotated compilation of 70 formally published reports dealing with noise and blast. The reports are arranged alphabetically by author. Author (GRA)

N72-16014# Notre Dame Univ., Ind. Lobund Lab.
BIBLIOGRAPHY OF GERMFREE RESEARCH, 1885-1963, 1969 SUPPLEMENT
Bernard A. Teah 1971 31 p refs
(Grant CA-07271-06)
(PB-202005; LOB/Bibl-69) Avail: NTIS CSCL 06C
A bibliography of 414 references concerning germfree research for the year 1969 is presented. GRA

N72-16767 Naval Ship Research and Development Center, Washington, D.C.
TESTING AND MODELING STANDING, MAN'S RESPONSE TO IMPACT
Joseph Gesswein and Paul Corrao *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 5-12 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16768 Birmingham Univ. (England). Dept. of Mechanical Engineering.
EQUAL ANNOYANCE CONTOURS FOR THE EFFECT OF SINUSOIDAL VIBRATION ON MAN
C. Ashley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 13-20 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16435*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TOXICOLOGY OF SPACECRAFT MATERIALS
Elliott S. Harris *In its* Conf. on Mater. for Improved Fire Safety 1971 p 207-210 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06T

N72-16039# Commissariat a l'Energie Atomique, Cadarache (France).
INSTANTANEOUS MEASUREMENT OF METABOLIC NEEDS OF PLANTS: AGRONOMIC AND POSSIBLY SPACE APPLICATIONS [MESURE INSTANTANEE DES BESOINS METABOIQUES DES PLANTES: APPLICATIONS AGRONOMIQUES ET EVENTUELLEMENT SPATIALES]
P. Guerin de Montgareuil, M. Andre, and P. Lespinat *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 310-319 In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

N72-16044# Kiel Univ. (West Germany). Inst. fuer Reine und Angewandte Kernphysik.
BASIC DATA OF COSMIC RADIATION
O. C. Allkofer *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 390-416 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

N72-16047# Christie Hospital and Holt Radium Inst., Manchester (England).
EFFECTS OF RADIATION AND ACCELERATION ON THE STRUCTURE OF CYTOPLASM IN VIVO
L. Cercek and B. Cercek *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 435-442 refs (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

N72-16048# Weizmann Inst. of Science, Rehovoth (Israel).
A SYSTEM OF DIFFERENTIATION IN VITRO OF AEDES AEGYPTI [UN SYSTEME DE DIFFERENTIATION IN VITRO: AEDES AEGYPTI]
M. Herzberg, H. Atlan, J. Peleg, and A. Shahar *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p p 443-454 In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

N72-16049# Laboratory of Molecular Embryology, Naples (Italy).
HOW CAN SPACE FACILITIES ANSWER FUNDAMENTAL QUESTIONS IN DEVELOPMENTAL BIOLOGY
A. Monroy *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 455-457 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

N72-16050# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Arbeitsgruppe Physikalische Raumforschung.
THE COMBINED ACTION OF INDIVIDUAL HEAVY NUCLEI OF COSMIC RADIATION AND SPACE FLIGHT FACTORS ON BIOLOGICAL SYSTEMS IN RESTING STATE: 'BIOSTACK'
H. Buecker *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 458-464 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

N72-16051# Toulouse Univ. (France). Faculte de Medecine et de Pharmacie.
RESEARCH PROJECT PRESENTED BY THE SPACE BIOLOGY GROUP [PROJET DE RECHERCHE PRESENTE PAR LE GROUPE DE BIOLOGIE SPATIALE]
H. Planel *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 465-509 In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-16015* Bendix Corp., Kennedy Space Center, Fla.
COLOR PERCEPTION TESTER Patent
Robert B. Martin, Eddie L. Brawner, and Wayne E. Pate, inventors (to NASA) Issued 28 Sep. 1971 4 p Filed 9 Sep. 1969 Sponsored by NASA

(NASA-Case-KSC-10278; US-Patent-3,609,740; US-Patent-Appl-SN-856327; US-Patent-Class-340-279; US-Patent-Class-35-8; US-Patent-Class324-66) Avail: US Patent Office CSCL 06B

A color perception tester is presented for testing individuals in order to determine if the individual can correctly identify wires in accordance with their respective color code. The tester includes a plurality of colored wires, which, when plugged in the appropriate receptacle or plug, will cause a pair of adjacent lamps to be illuminated. Indicia are printed adjacent the plug identifying the proper colored wire which should be plugged in the circuit. Official Gazette of the U.S. Patent Office

N72-16016*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

BEHAVIORAL, PSYCHIATRIC, AND SOCIOLOGICAL PROBLEMS OF LONG-DURATION SPACE MISSIONS

Nick A. Kanas (Univ. of Southern Calif., Los Angeles) and William E. Fedderson Oct. 1971 90 p refs (NASA-TM-X-58067) Avail: NTIS CSCL 05E

A literature search was conducted in an effort to isolate the problems that might be expected on long-duration space missions. Primary sources of the search include short-term space flights, submarine tours, Antarctic expeditions, isolation-chamber tests, space-flight simulators, and hypodynamia studies. Various stressors are discussed including weightlessness and low sensory input; circadian rhythms (including sleep); confinement, isolation, and monotony; and purely psychiatric and sociological considerations. Important aspects of crew selection are also mentioned. An attempt is made to discuss these factors with regard to a prototype mission to Mars. Author

N72-16017*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN ELECTRONIC CIRCUIT THAT DETECTS LEFT VENTRICULAR EJECTION EVENTS BY PROCESSING THE ARTERIAL PRESSURE WAVEFORM

Vernon D. Gebben and John A. Webb, Jr. Feb. 1972 4 p (NASA-TM-X-68001) Avail: NTIS CSCL 06B

An electronic circuit for processing arterial blood pressure waveform signals is described. The circuit detects blood pressure as the heart pumps blood through the aortic valve and the pressure distribution caused by aortic valve closure. From these measurements, timing signals for use in measuring the left ventricular ejection time is determined, and signals are provided for computer monitoring of the cardiovascular system. Illustrations are given of the circuit and pressure waveforms. E.H.W.

N72-16018# Joint Publications Research Service, Washington, D.C.

CORRELATION BETWEEN ELECTROGRAPHIC TRACE PHENOMENA IN THE BRAIN AND IMMEDIATE MEMORY

L. G. Voronin, V. F. Konovalov, R. Ya. Senina, and I. S. Serikov 27 Jan. 1972 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 201, no. 1, 1971 p 253-256 (JPRS-55048; UDC-612.821.6.001.5) Avail: NTIS

An effort to measure the retention mechanism of the human brain is discussed. Tests were conducted on 70 healthy subjects ranging in age from 5 to 35 years, and on 46 patients suffering from alcoholism and cerebrosclerosis. The subjects were given pairs of auditory and photic stimuli at specific intervals. After the stimuli the subjects were asked to identify pictures or signals they had seen or heard. When the subject started to make mistakes, the last correct identification sequence made served as the criterion of volume of immediate memory. Results show 5 to 6 year olds retained traces for 252 to 306 seconds, 8 to 10 year olds retained traces for 144 to 234 seconds, and 16 to 35 year olds retained traces for 126 to 144 seconds. Patients with memory disorders showed a marked increase in time of retention of traces to neutral stimuli: 360 to 400 seconds. E.H.W.

N72-16019# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

HUMAN FACTORS ENGINEERING [ANTHROPOTECHNIK]

1970 76 p In GERMAN Proc. of a Seminar held at Meckenheim, West Ger., 11-12 Jun. 1970 (Anthropotech-4/70) Avail: NTIS

Research facilities, mission, and performance data processing at the German Research Institute for Human Factors Engineering are summarized. The distribution of display devices in control cabins and psychological measurements in human factors laboratories are discussed. For individual titles, see N72-16020 through N72-16028.

N72-16020# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

THE RESEARCH INSTITUTE FOR HUMAN FACTORS ENGINEERING [DAS FORSCHUNGSINSTITUT FUER ANTHROPOTECHNIK]

G. W. Radl *In its* Human Factors Eng. 1970 p 9-17 In GERMAN (See N72-16019 07-05) Avail: NTIS

A description is given of the test equipment available at the German Research Institute for Human Factors Engineering. This institute is concerned with improvement of man machine systems, especially with the adaptation of vehicles to man and vice versa. This includes information systems, computerized simulation, and the role of man in automatic control systems. ESRO

N72-16021# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

STATIC MACHINE-TO-MAN ADAPTATION [STATISCHE ADAPTATION DER MASCHINE AN DEN MENSCHEN]

G. Rothbauer *In its* Human Factors Eng. 1970 p 18-22 In GERMAN (See N72-16019 07-05) Avail: NTIS

Static adaptation of machine to man implies a knowledge of human size, muscle forces, and sensivity limits. Data to be collected and the way the extreme values should be included are discussed. Other elements of interest such as clothing, display devices, and feedback control are analyzed. ESRO

N72-16022# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

DYNAMICAL ADAPTATION [DYNAMISCHE ADAPTATION]

E. Donges *In its* Human Factors Eng. 1970 p 23-27 In GERMAN (See N72-16019 07-05) Avail: NTIS

The capacity of man, as part of a dynamic control system, to adapt himself to changes in the input or noise signals, is considered. The quasi-linear model and the crossover model are discussed, and it is shown that the optimization criterion appears to be the minimization of the root mean square error. ESRO

N72-16023# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

PROBLEMS OF INDICATOR DISPLAYS IN AIRCRAFT [PROBLEME DER ANZEIGENAUSLEGUNG BEI LUFTFAHRZEUGEN]

Hannelore Radl-Koethe *In its* Human Factors Eng. 1970 p 28-35 In GERMAN (See N72-16019 07-05) Avail: NTIS

Visual aids and display systems for flight control, navigation, and engine control, are discussed. Position, form, color, and illumination of indicators are discussed in relation to optimal perception by the pilot. ESRO

N72-16024# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).

DISPLACEMENT/RESISTANCE CHARACTERISTIC OF THE

CONTROL STICK [WEG-WIDERSTANDS-CHARAKTERISTIK DES LENKKNEUPPELS]
K. F. Kraiss *In its* Human Factors Eng. 1970 p 36-43 In GERMAN (See N72-16019 07-05)
Avail: NTIS

The system man/control stick is considered. Man is represented as the addition of a conscient component and a proprioceptive component. The response times of these two parts are different, and thus man forms a nonlinear system. The reaction to sensory feedback was analyzed. ESRO

N72-16025# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
TEST PLANNING AND DATA EVALUATION [VERSUCHSPLANUNG UND DATENAUSWERTUNG]
G. W. Radl *In its* Human Factors Eng. 1970 p 44-49 In GERMAN (See N72-16019 07-05)
Avail: NTIS

Some functions of man as part of a man machine system must be observed and recorded in artificial conditions. These points were analyzed. Test methods and processing of human performance data in human factors laboratories are discussed. Several statistical methods and their limitations are also considered. ESRO

N72-16026# Forschungsinstitut fuer Anthropotechnik, Mechenheim (West Germany).
METHODS OF FLIGHT SIMULATION [VERFAHREN DER SICHTSIMULATION] c11
K.-P. Gaertner *In its* Human Factors Eng. 1970 p 50-58 In GERMAN (See N72-16019 07-05)
Avail: NTIS

In present flight simulators the representation of the landscape is still a problem. Several processes for storing the image of the landscape are described, including drawings, three-dimensional models, and two-dimensional models, such as photographs, films, lists, and stored digital images. Each system is described and its disadvantages enumerated. ESRO

N72-16027# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
POSSIBILITIES FOR MEASURING PSYCHOLOGICAL STRAIN [MESSMOEGLICHKEITEN PSYCHISCHER BEANSPRUCHUNG]
G. W. Radl *In its* Human Factors Eng. 1970 p 59-68 In GERMAN (See N72-16019 07-05)
Avail: NTIS

Psychological reactions of a pilot were analyzed in a human factors laboratory. Methods for quantitative psychological analysis are described, including the evaluation of task difficulty by trained external observers, empirical performance evaluation, secondary task evaluation, measurement of physiological parameters, interviews, and questionnaires. ESRO

N72-16028# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
DATA ACQUISITION AT THE RESEARCH INSTITUTE FOR HUMAN FACTORS ENGINEERING [DATENERFASSUNG AM FORSCHUNGSINSTITUT FUER ANTHROPOTECHNIK] c08
K. R. Kimmel *In its* Human Factors Eng. 1970 p 69-74 In GERMAN (See N72-16019 07-05)
Avail: NTIS

The equipment available for data processing is described. Data is input via a 32-channel device and fed to a tape recorder. Analog data are digitized and stored as digital data on magnetic tapes for further processing on external computers. ESRO

N72-16029# European Space Research Organization, Paris (France).
SPACE BIOLOGY RELATED TO THE POST-APOLLO PROGRAMME
Aug. 1971 524 p refs Partly in ENGLISH and partly in FRENCH Proc. of a Colloq. held in Paris, 15-17 Mar. 1971; sponsored jointly by Council of Europe, Intern. Cell Res. Organ., Intern. Union of Cardiology, European Soc. for Radiation Biol., European Cell Biol. Organ., and Intern. Assoc. of Gerontology (ESRO-SP-73) Avail: NTIS HC $6.00/MF $0.95

The utilization opened up by the post-Apollo program in the field of biology and medicine is discussed, and the advantages which European biological and medical research might derive from laboratory uses of the space shuttle are outlined. For individual titles, see N72-16030 through N72-16051.

N72-16030*# National Aeronautics and Space Administration, Washington, D.C.
AN OVERVIEW OF THE NASA POST-APOLLO PROGRAM c34
B. Bernier *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 7-56 (See N72-16029 07-05)
(NASA-TM-X-67497) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

An overview is given of NASA's future plans and programs as they are reflected in the 1972 budget submitted to Congress. Among the continuing programs are the four remaining Apollo flights, Skylab, solar observations, meteorological and earth resources satellites and unmanned planetary exploration. New efforts include the space shuttle, high energy astronomy observatory, outer planets exploration and STOL research aircraft. International, in particular European, cooperation is also considered. ESRO

N72-16031*# National Aeronautics and Space Administration, Washington, D.C.
FLIGHT RESULTS IN MANNED SPACE FLIGHTS TO DATE AND PROPOSED PROGRAMME FOR SKYLAB MEDICAL EXPERIMENTS
S. White *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 57-99 (See N72-16029 07-05)
(NASA-TM-X-67504) Avail: NTIS HC $6.00/MF $0.95 CSCL 06E

Significant medical results from the Gemini and Apollo flights are assessed, and include loss of red cell mass, cardiovascular deconditioning, loss of exercise capacity and bone density, body weight loss and metabolic expenditure. The proposed program for Skylab medical experiments is discussed and covers such aspects as the musculoskeletal system, cardiovascular function, hematology and neurophysiology, pulmonary functions and biotechnology experiments. ESRO

N72-16032*# National Aeronautics and Space Administration, Washington, D.C.
THE INTERACTION OF LIVING SYSTEMS WITH THE SPACE ENVIRONMENT OBSERVATIONS FROM THE UNITED STATES SPACE BIOLOGY MISSIONS
J. F. Saunders *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 100-181 refs (See N72-16029 07-05)
(NASA-TM-X-67505) Avail: NTIS HC $6.00/MF $0.95 CSCL 06C

The evolution of space biology is briefly considered with reference to the USSR programs. The NASA experiments over the past decade, flown in particular on Gemini and Biosatellites 1, 2, and 3, are discussed and the future programs described. The effects of aerospace environment, in particular weightlessness, are discussed in relation to viruses and bacteria, cellular systems, plants, invertebrates, amphibians, and primates. ESRO

N72-16033*# National Aeronautics and Space Administration, Washington, D.C.
LIFE SCIENCES ASPECTS OF THE SPACE SHUTTLE AND SPACE STATION
S. White *In* ESRO Space Biology Related to the Post-Apollo

Programme Aug. 1971 p 182-234 (See N72-16029 07-05)
(NASA-TM-X-67506) Avail: NTIS HC $6.00/MF $0.95 CSCL 06K

The space station concept is considered in the light of achieving an interpretation of bioscience, biotechnology, and biomedicine aspects. The objectives and details of such a life science program are discussed and the research facilities and equipment in the station are described. ESRO

N72-16034*# California Univ., Berkeley. Lawrence Radiation Lab.
LIGHT FLASH PHENOMENON SEEN BY ASTRONAUTS
T. F. Budinger, C. A. Tobias, J. T. Lyman, P. K. Chapman (NASA. Manned Spacecraft Center, Houston Tex.), L. S. Pinsky (NASA. Manned Spacecraft Center, Houston, Tex.), H. Bichsel (Washington Univ.), J.D. Denney (Washington Univ.), and W. B. Nelp *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 235-270 refs Sponsored by NASA (See N72-16029 07-05)
(Contracts W-7405-eng-48; AT(45-1)2225; Grant PHS-CA-t2446)
(NASA-CR-1235453) Avail: NTIS HC $6.00/MF $0.95 CSCL 06P

Experiments conducted on earth at cyclotrons together with observations made by Apollo astronauts suggest that cosmic nuclei interacting with the visual apparatus cause the phenomenon of light flashes seen on the four Apollo moon missions. Experiments with high and low energy neutron beams and 5 cm range helium ions suggest that slow protons and helium ions with a stopping power greater than 10 to the 8th power eV/gram sq cm cause light flashes and streaks in the partially dark adapted eye. The fact that charged particles induced by neutrons and helium ions stimulate the visual apparatus is demonstrated and some approaches to understanding the long term mission effects of galactic cosmic nuclei interacting with man are indicated. Author (ESRO)

N72-16035# Centre de Recherches Nucleaires, Strasbourg (France).
SOME POSSIBILITIES FOR COLLABORATION IN THE POST-APOLLO PROGRAM [QUELQUES POSSIBILITES DE COLLABORATION AU PROGRAMME POST-APOLLO]
P. Cuer *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 271-278 In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

The structure and activities of the astrobiophysics group within the Council of Europe are described and general ideas on three projects are presented which the group has put forward for the post-Apollo program. The summarized projects throw light on cosmic rays and heavy ion acceleration and the effects of cosmic rays and heavy ions on cells and tissues. ESRO

N72-16036# Bordeaux Univ. (France). Dept. of Physiology.
SEARCHES FOR PHYSIOLOGICAL MECHANISMS CONCERNING THE MODIFICATIONS OF BEHAVIOR IN WEIGHTLESSNESS [RECHERCHES DES MECANISMES PHYSIOLOGIQUES CONCERNANT LES MODIFICANTIONS DU COMPORTHMENT EN ABSENCE DE PESANEUR]
R. Crandpierre *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 279-294 refs In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

The effects of weightlessness on animals and humans are discussed with reference to previous experiments. The diminuation of physiological responses are particularly considered together with pulmonary and cerebral circulation. The measuring equipment is also briefly described. ESRO

N72-16037# Bordeaux Univ. (France). Dept. of Physiology.
TECHNIQUE FOR MEASURING AND CONTINUED RECORDING OF THE PARTIAL PRESSURE OF OXYGEN IN ARTERIES OF SUPERIOR VERTEBRATES IN VIEW OF A SPACE EXPERIMENT [TECHNIQUE DE MESURE ET ENREGISTREMENT CONTINUE DE LA PRESSION PARTIELLE D'OXYGENE DANS LE SANG ARTERIEL CHEZ DES VERTEBRES SUPERIEURS EN VUDE D'UNE EXPERIENCE SPATIALE]
R. Grandpierre and P. Baum *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 295-300 refs In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

A technique, using an electrode, is described for measuring the partial pressure of oxygen in arteries. Results of experiments conducted on rabbits, dogs, and monkeys are given. ESRO

N72-16038# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Forschungsgruppe fuer Extraterrestrische Biologie.
PREPARATION OF A SPACE EXPERIMENT
R. Lotz *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 301-309 refs (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

The preparation of space biological experiments is discussed with reference to hirudo medicinalis. Specific aspects such as life support systems are described and possible European cooperation in space biology noted. ESRO

N72-16039# Commissariat a l'Energie Atomique, Cadarache (France).
INSTANTANEOUS MEASUREMENT OF METABOLIC NEEDS OF PLANTS: AGRONOMIC AND POSSIBLY SPACE APPLICATIONS [MESURE INSTANTANEE DES BESOINS METABOIQUES DES PLANTES: APPLICATIONS AGRONOMIQUES ET EVENTUELLEMENT SPATIALES]
c04
P. Guerin de Montgareuil, M. Andre, and P. Lespinat *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 310-319 In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

A method is described which consists of an automatic means for continuous measurement and regulation when necessary of the various parameters essential for plant growth. The agronomic aspects are considered and related to space biology. ESRO

N72-16040# Ulm Univ. (West Germany). Abteilung fuer Klinische Physiologie.
CELL PHYSIOLOGICAL PROBLEMS IN SPACE MEDICINE
T. M. Fliedner and O. Bock *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 320-333 refs (See N72-16029 07-05)
(Contract EURATOM-079-69-1-BIAC)
Avail: NTIS HC $6.00/MF $0.95

Cell system physiology is considered relevant to space missions since the long-term adaptation of humans to environmental conditions is maintained through the adaptive capabilities of cell systems. These capabilities, especially cell renewal, are discussed in relation to the epithelium, hematopoietic and lymphopietic systems using eruthroposiesis as an example of cell system regulation. The physical, chemical and microbial effects on the cells are also discussed. ESRO

N72-16041# Centre Hospitalier Universitaire, Creteil (France).
THE VENTILATION MECHANISM IN WEIGHTLESSNESS [LA MECANIQUE VENTILATOIRE EN NON PESANTEUR]
C. Jacquemin *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 334-344 refs In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

Experiments were carried out to study the pulmonary ventilation mechanism in weightlessness conditions. It is shown that a plesthysmograph can be used in weightlessness conditions

to measure the outgoing gas flow. The input data are the action of the diaphragm which is measured by electromyography. One of the main difficulties was the calibration of pressure measuring instruments and some new experiments which should be performed are given. They include the study of pulmonary circulation by maintaining the lower part of the body at a pressure lower than that of the thorax and the variation of the lung volume with respect to pressure. ESRO

N72-16042# Royal Coll. of Surgeons, Dublin (Ireland). Dept. of Physiology.
HUMAN CIRCADIAN RHYTHMS AND SPACE RESEARCH
R. T. W. L. Conroy *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 345-351 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

The circadian rhythm is described and the difference between exogenous and endogenous rhythms explained. It is shown that the endogenous rhythm is an important factor in space missions. ESRO

N72-16043# College Scientifique Universitaire de Tours (France). Lab. of Physiology.
STUDY OF THE WEIGHTLESSNESS AND PERTURBATIONS OF THE RHYTHMS IN THE GASTROINTESTINAL SYSTEM OF ANIMALS AND HUMAN BEINGS [ETUDE DE L'AGRAVITE ET DES PERTURBATIONS DES RHYTHMES SUR LE TRACTUS GASTRO-INTESTINAL CHEZL'ANIMAL ET CHEZ L'HOMME]
J. Thouvenot and C. Gaudeau (Lab. de Rech. Avancees en Moyens d'Informatique) *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 352-389 refs In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

A method is described for obtaining bioelectric signals from the viscera in animals and humans. Biological effects are discussed as well as analyses of the signals. Experiments using the method are also described. ESRO

N72-16044# Kiel Univ. (West Germany). Inst. fuer Reine und Angewandte Kernphysik.
BASIC DATA OF COSMIC RADIATION **c04**
O. C. Allkofer *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 390-416 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

Cosmic rays can be regarded from four aspects: astrophysics, geophysics, elementary particle physics, and biophysics. The first three are briefly considered and the biophysical aspects discussed in more detail. The main characteristics of galactic and solar radiation are described and the radiation hazards discussed. ESRO

N72-16045# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.
ECOPHYSIOLOGY AND SPACE FLIGHT
W. Briegleb *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 417-425 refs (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

After a general introduction to geobiology, the effects of weightlessness are discussed in general terms. An experiment for simulating weightlessness is briefly described and results of other experiments summarized. ESRO

N72-16046# Consiglio Nazionale delle Ricerche, Genoa (Italy). Lab. of Cybernetics and Geophysics.
PATTERN FORMATION IN DISSIPATIVE SYSTEMS **c12**
F. Gambale and A. Gliozzi *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 426-434 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

An experiment is described in which the coupling between diffusion and convection in biological membranes gives rise to organized patterns. The occurrence of instabilities is analyzed, taking into account the upper and lower boundary layers. ESRO

N72-16047# Christie Hospital and Holt Radium Inst., Manchester (England).
EFFECTS OF RADIATION AND ACCELERATION ON THE STRUCTURE OF CYTOPLASM IN VIVO **c04**
L. Cercek and B. Cercek *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 435-442 refs (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

After emphasizing the importance of cell structure on optimum organization in space, results obtained by measuring changes in the structure of cytoplasm in vivo caused by acceleration and radiation are discussed. Among the types of material used were root-cap cells of barley and yeast. Experiments in conjunction with space flight are also considered. ESRO

N72-16048# Weizmann Inst. of Science, Rehovoth (Israel).
A SYSTEM OF DIFFERENTIATION IN VITRO OF AEDES AEGYPTI [UN SYSTEME DE DIFFERENTIATION IN VITRO: AEDES AEGYPTI] **c04**
M. Herzberg, H. Atlan, J. Peleg, and A. Shahar *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p p 443-454 In FRENCH (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

A diploid system of differentiation in vitro of aedes aegypti is described and the cultivation and cycle of the mosquito cells are discussed. ESRO

N72-16049# Laboratory of Molecular Embryology, Naples (Italy).
HOW CAN SPACE FACILITIES ANSWER FUNDAMENTAL QUESTIONS IN DEVELOPMENTAL BIOLOGY **c04**
A. Monroy *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 455-457 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

These systems: unicellular alga, acetabularia; differentiation of nerve cells; and development of amphibia eggs are briefly considered in an attempt to answer the question of whether experiments in development biology could be carried out in space flight. ESRO

N72-16050# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Arbeitsgruppe Physikalische Raumforschung.
THE COMBINED ACTION OF INDIVIDUAL HEAVY NUCLEI OF COSMIC RADIATION AND SPACE FLIGHT FACTORS ON BIOLOGICAL SYSTEMS IN RESTING STATE: 'BIOSTACK' **c04**
H. Buecker *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 458-464 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

The biological effects of heavy nuclei of cosmic rays during spaceflight are investigated in order to see whether the effects produced by the cosmic ions differ from those of accelerators. The biological effects are noted and the contents of the experimental package is described. ESRO

N72-16051# Toulouse Univ. (France). Faculte de Medecine et de Pharmacie.
RESEARCH PROJECT PRESENTED BY THE SPACE BIOLOGY GROUP [PROJET DE RECHERCHE PRESENTE PAR LE GROUPE DE BIOLOGIE SPATIALE] **c04**
H. Planel *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 465-509 In FRENCH (See N72-16029 07-05)

Avail: NTIS HC $6.00/MF $0.95

The experimental projects of the space biology group of the CNRS are presented. Three projects are singled out for fuller discussion. These are the effects of cosmic radiation on aging and lifespan, the effects of cosmic radiation on cells and the lesion-producing action of heavy ions on the cerebral cortex.

ESRO

N72-16052# Institut Za Nuklearne Nauke (Boris Kidric), Belgrade (Yugoslavia).

HEALTH PHYSICS INSTRUMENTATION AND SYSTEMS

S. Muzdeka, A. Koturovic, M. Sobajic, M. Smelcerovic, D. Damljanovic, and B. Kovac May 1971 20 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/352; Conf-710901-119) Avail: AEC Depository Libraries

Health physics instruments and systems developed at the Boris Kidrich Institute are described. Topics include portable measuring meters and monitors, sample measurements, mobile laboratory for radioprotection, and instrumentation systems and networks.

NSA

N72-16053# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

VERTICAL COCKPIT ACCELERATIONS MEASURED ON AN OPERATIONAL JET TRANSPORT AIRCRAFT

G. B. Hutton 1971 28 p refs Supersedes RAE-TR-69214; ARC-32768

(RAE-TR-69214; ARC-CP-1183; ARC-32768) Avail: NTIS; HMSO: 40p; PHI: $1.75

An analysis was made of vertical accelerations recorded in the cockpit of a Boeing 707-436 jet transport aircraft during take-off and landing. Twenty-five take-offs and twenty-five landings from twenty airports were studied. The results could be used to prepare a flight simulator input program representing a generalized flight deck vibration environment of a subsonic jet transport aircraft. Turbulence response data from 9436 flying hours on the same type of aircraft was used to obtain assessments of the probability of exceeding various levels of cockpit acceleration while airborne for comparison with the high speed taxying phases of landing and take-off. Author (ESRO)

N72-16054# School of Aerospace Medicine, Brooks AFB, Tex.

EAR PROTECTION PROVIDED BY SEVERAL STANDARD AIR FORCE DEVICES Final Report, Nov. 1970 - Feb. 1971

Harrell C. Sutherland, Jr., Donald C. Gasaway, and George N. Wren May 1971 21 p refs

(AF Proj. 7755; Work Order 002)

(AD-731123; SAM-TR-71-15) Avail: NTIS CSCL 06/17

Sound attenuation achieved with several routinely procured standard Air Force devices was determined with 10 subjects. Devices and their combinations studied were: earplugs, earmuffs, earplugs and earmuffs, communication-type headset-microphone, and headset-microphone with dry cotton in the ear canals. Results indicate that occasionally a need may exist to measure the protection an individual is getting with ear-protective devices. Also, results with the earmuffs were somewhat different from results found at another facility. Attenuation resulting from dry cotton and a headset-microphone in combination suggests the need to investigate speech intelligibility with that condition.

Author (GRA)

N72-16055# Harry Diamond Labs., Washington, D.C.

A STUDY OF LASER EYE PROTECTION BY DIRECT INITIATION OF THIN EXPLOSIVE WAFERS

Z. G. Sztankay and R. J. Holland Aug. 1971 48 p refs

(DA Proj. 1T0-61101-A-91-A; HDL Proj. ILR91)

(AD-731780; HDL-TR-1556) Avail: NTIS CSCL 20/6

A system is described that protects eyes of personnel using optical sighting devices from laser radiation throughout the visible and near IR range. A key element is an explosive-mirror assembly capable of being destroyed by a laser burn beam before it reflects the optically delayed see beam to a viewer's eyes. The work was concentrated on polyvinyl alcohol lead azide. Explosive wafers as thin as 0.0025 cm were pressed and confined next to the mirror with epoxy. Instrumentation permitting 10-nsec resolution was developed to measure initiation and mirror destruction times. The PVA lead azide charge doped with 1 and 2.6% by weight of carbon black destroyed mirrors in as little as 20 nsec, when initiated by beams focused to energy densities of > or = 10 J/sq cm. Focusing to this level may be possible with a beam that is at the threshold eye-damaging intensity. Destruction times at focused energy densities of approximately 1 J/sq cm were 100 nsec, but improvements may reduce this to the required 30 nsec. Author

N72-16056# Illinois Univ., Urbana. Aviation Research Lab.

A VISUAL LANDING SIMULATOR FOR A GROUND BASED TRAINER M.S. Thesis

Martin John Michlik May 1971 45 p refs

(Contract F44620-70-C-0105; AF Proj. 9778)

(AD-732323; ARL-71-10; AFOSR-71-3; AFOSR-71-2615TR) Avail: NTIS CSCL 05/9

Electrical circuitry was developed to utilize voltage signals from a Link general aviation trainer (GAT-1) to drive a visual display system simulating the changing geometry of the outline of a runway as seen by a pilot while landing. The resulting landing simulator is to be used as part of a study of pilot training techniques. The circuitry was based on a series of geometric equations previously developed for such a visual display. The GAT-1 voltage signals represented the aircraft's altitude, range from the end of the runway, and right-left angular deviation from the extended runway centerline. The outputs of the circuitry were used to drive a mechanical shutter system that, together with a simple overhead projector, generated the images of the four edges of the runway. The projected runway image was found to agree with that calculated from the geometric equations to within four percent. Author (GRA)

N72-16057# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

ANALYSIS OF THE FACTORS GOVERNING THE SCHEDULING OF FLIGHT CONTROLLERS IN SUPPORT OF LONG DURATION MANNED SPACEFLIGHT MISSIONS M.S. Thesis

Carroll E. Hopkins Dec. 1971 187 p refs

(AD-731765; GSM/SM/71-6) Avail: NTIS CSCL 05/9

The study has two main purposes: to identify the factors, or variables, that govern the scheduling of flight controllers in support of long duration manned spaceflight; and to develop a scheduling system that best satisfies the needs of these personnel and the activity they support. A review of related research yielded a tentative list of nine scheduling variables: fatigue, flexibility of schedules, length of shift, morale, office work, overtime, personnel qualifications, shift cycle, and training. A questionnaire was developed to verify these variables, to measure the relative importance of them, and to determine which of five proposed schedules were perceived by the flight controllers as being the best. Hypotheses were tested to determine if the flight controllers and their supervisors perceive the importance of these scheduling variables differently. Other organizations performing similar tasks were studied to provide a data base of scheduling systems in use. A schedule is proposed which the author says will provide the best mission support.

Author (GRA)

N72-16058# North American Rockwell Corp., Los Angeles, Calif.

LIFE SUPPORT SYSTEMS REQUIREMENTS. VOLUME 5: APPENDIXES B, C, AND D Final Report, Oct. 1969 - Jul. 1970

Marvin N. Goldberg, William J. Adams, and James W. Raeke Wright-Patterson AFB, Ohio ASD Nov. 1970 441 p refs

(Contract F33657-70-C-0374; AF Proj. 421A)
(AD-732163; NA-70-397-Vol-5; ASD-70-47-Vol-5) Avail: NTIS HC $6.00/MF $0.95 CSCL 06/11

The volume contains the top level, life support system, functional analysis and requirement allocation sheets (RAS's) in conjunction with the first three levels below top. RAS's presented are a two-part format. RAS-A provides the functional performance requirements relative to aircraft/mission/environment matrix. RAS-B provides documentation of support requirements to maintain adequate aircrew performance levels for the various environmental stressors potentially encountered on various types of missions undertaken. Author (GRA)

N72-16059# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.
EFFECTS OF G AND TARGET POSITION ON STATIC HELMET SIGHTING Final Report
Carl Reichwein, Joseph Cunningham, and Richard J. Crosbie 31 Dec. 1970 38 p refs
(Airtask-ZF32-412-001; IED Proj. SD-1)
(AD-731728; NADC-MR-7023) Avail: NTIS CSCL 05/9

Preliminary experiments were performed on the NADC Human Centrifuge to determine the effect of steady-state -G sub c accelerations on the subject's ability to aim a helmet-mounted sight at stationary targets located at four extreme positions in the subject's field of view. Performance was measured as percent time on target. Average performance decrements ranged were obtained for elevated and eye-level targets. Asymmetrical target performance scores were noted. Coriolis effects were noted also. GRA

N72-16060# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
CENTRIFUGE VALIDATION OF A TACTILE G-LIMIT WARNING DEVICE Final Report
David E. Thorburn Aug. 1971 10 p
(Task-718410)
(AD-732194; AMRL-TR-71-80) Avail: NTIS CSCL 06/17

The purpose of the experiment was to evaluate the effectiveness of a tactile, pulsating, warning signal under G-load conditions. Subjects were required to respond to a tactile pulsating signal in their anti-G suit while under varying G loads by pulling a trigger on their control stick. The tactile G-limit warning pulse proved to be a very effective signaling device. Not one warning signal at any frequency was missed by any subject. One subject even reported feeling the signal after he had blacked out which points out the obvious advantage of a tactile warning in not requiring a pilot visual or even audio attention.
Author (GRA)

N72-16061# TRW Systems Group, Redondo Beach, Calif.
MAGNETIC RECORDING OF THE HEART'S ELECTRICAL ACTIVITY WITH A CRYOGENIC MAGNETOMETER Final Report
A. Rosen, G. T. Inouye, A. L. Morse, D. L. Judge, and S. C. K. Liu 4 Jun. 1971 71 p refs
(Contract PHS-69-2243)
(PB-201939; TRW-13207-6014-RO-00) Avail: NTIS CSCL 06P

A two junction superconducting Josephson tunneling magnetometer has been developed for the measurement of magnetic field strengths of the order of 10 to the minus ten gauss per Hz to the 1/2 power in an unshielded environment. The application of the device to the measurement of the heart's magnetic signature, the magnetocardiogram; and the problems associated with the measurement techniques are discussed. It is demonstrated that the fine details of the heart's magnetic signature (the magnetocardiogram) can be resolved in real time in an unshielded environment. Author (GRA)

N72-16062# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A MODEL OF A VISUAL ANALYSOR AND THE PROBLEM OF PATTERN RECOGNITION
Yu. I. Nikolaev 10 Aug. 1971 19 p refs Transl. into ENGLISH from the publ. "Seminar po Kibernetike. Modelirovaniye Biologicheskikh Sistem. Materialy. no. 8" 11 1969 p 30-41
(DIA-Task-T71-05-09; DIA-Task-T71-05-13)
(AD-731898; FTD-MT-24-73-71) Avail: NTIS CSCL 06/4

The ocular movements of tremor and drift are well known to physiologists but their purpose is unknown. The work describes a model of a peripheral section of a visual analysor which offers an explanation for the functions of these movements and considers them as a specialized system for the active analysis of images which are moved to the periphery by the organism. In addition, the model permitted looking at the recognition process as a dynamic process (and not a static process) in a new manner. Author (GRA)

N72-16063# Naval Training Device Center, Orlando, Fla. Computer Lab.
INSTRUCTOR CONSOLE INSTRUMENT SIMULATION Interim Report, May 1970 - Jun. 1971
John L. Booker and Igor V. Golovcsenko Sep. 1971 45 p
(NAVTRADEVCEN-Task-7884-27)
(AD-731739; NAVTRADEVCEN-IH-195) Avail: NTIS CSCL 05/9

The object of the task is to investigate the use of computer generated display devices in training device instructor console applications. The first phase in accomplishing this objective is to demonstrate the ability to provide all control and monitoring functions presently available from conventional instructor consoles. Typical functions to be provided are the insertion of various normal and abnormal problem conditions, the initiation of various test aid functions, control over the modes of operation, and a duplicate set of instruments and indicators from the simulated vehicle trainee station. Author (GRA)

N72-16064# Illinois Univ., Urbana. Biological Computer Lab.
NATURAL NUMBERS IN TRANSCLASSIC SYSTEMS
Gotthard Gunther 1 Nov. 1970 46 p refs
(Grants AF-AFOSR-1865-70; AF-AFOSR-1391-68; AF Proj. 9768)
(AD-732294; BCL-3.4; UILU-ENG-70-299; AFOSR-71-2802TR; Rept-61102F; Rept-681305) Avail: NTIS CSCL 06/4

The reason why natural numbers follow the unilinear sequence prescribed by the Peano axioms is that these axioms presuppose that natural numbers are mapped unto the classic two-valued system of logic. If the same numbers are mapped unto transclassic systems of logic which contain an indefinite number of values any natural number selected may have several immediate predecessors and an indefinite number of immediate successors. The number of predecessors or successors depends on whether the structural basis of counting is provided by proto-, deutero-, or trito-structure. The paper shows the sequences which the numbers follow in each of these cases and their horizontal structural relations. Author (GRA)

N72-16426*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO SPACE-SUIT MATERIALS
Frederick S. Dawn and Ralph L. Jarboe *In its* Conf. on Mater. for Improved Fire Safety 1971 p 145-149 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06Q

N72-16432*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPECIALIZED TESTING AND EVALUATION OF SPACE-SUIT MATERIALS
Thomas J. Ballentine *In its* Conf. on Mater. for Improved Fire Safety 1971 p 187-190 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06Q

N72-16434*# MSC White Sands Test Facility, N.Mex.
ODOR TEST
L. A. Schluter and D. L. Pippen *In its* Conf. on Mater. for Improved Fire Safety 1971 p 203-205 ref (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06K

N72-16974# Joint Publications Research Service, Washington, D.C.
PHILOSOPHICAL PROBLEMS OF THE CONTROL OF THE BIOSPHERE
M. N. Rutkevich and S. S. Shvarts *In its* Readings in Soviet Cybernetics and Sociology 19 Jan. 1972 p 36-53 refs (See N72-16971 07-34)
Avail: NTIS

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-16065 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF DECOMPOSITION OF SUPERSATURATED Cr BASED SOLID SOLUTION IN Cr-Ni SYSTEM
G. F. Sarzhan, V. I. Trefilov, and S. A. Firstov 19 Nov. 1971 5 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 31, no. 2, 1971 p 294-298 In ENGLISH and RUSSIAN
(NLL-Trans-746-1044-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

It is shown that, during the decomposition of a supersaturated chromium-base solution in the low temperature area, the intermediate beta phase is precipitated from the hexagonal close packed lattice, and is rearranged into the stable gamma phase with the F.C.C. lattice with an increase in the temperature of annealing. The orientation relationships of the matrix and the precipitating phases were established. It was also shown that, during quenching of the alloys from the single phase area, it was not possible to retain the solid solution and prevent decomposition. The nature of certain anomalies, observed during annealing of the quenched Cr-Ni alloys is also discussed. Author

N72-16066 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF MASS EXCHANGE CHARACTERISTICS OF A RECTIFICATION COLUMN FOR PURIFYING TITANIUM TETRACHLORIDE BY MEANS OF A COMPUTER
D. I. Lisovskii, V. A. Ivankov, and V. I. Shvartsev Nov. 1971 7 p refs Transl. into ENGLISH from Izv. VUS Tsvet. Met (USSR), v. 13, no. 6 p 129-133
(NLL-RTS-6762) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.70; 2 NLL photocopy coupons

A mathematical model is developed for rectification column with plates of the straight-through lattice type. The following assumptions were made: the reflux in the column is supplied at boiling temperature; the condensor of the column is supplied at boiling temperature; the condensor is full; the column operates adiabatically and the pressure is uniform at all levels of the columns; no removal of the liquid takes place from the plates; the velocity of the vapor is constant within the column height; and the composition of liquid and vapor is identical in the evaporator. It is concluded that the mass exchange characteristics may be determined by experimentally measured regimes; the effect of the liquid and vapor concentration on the plates and the presence of liquid phase mixture can be neglected. As a result, the coefficient of mass loss in the vapor phase is found as a quadratic function from the speed vapor and the coefficient of mass loss in the liquid phase is a constant. Author

N72-16067*# AeroChem Research Labs., Inc., Princeton, N.J.
FLUORINE NEGATIVE ION DETACHMENT KINETICS Final Report
Rudolf R. Burke, William J. Miller, and Robert K. Gould Nov. 1971 27 p refs
(Contract NAS1-9710)
(NASA-CR-112010; AeroChem-TP-270) Avail: NTIS CSCL 07B

A study of the rate of F(-) detachment by O and H atoms via the reactions F(-) + O yields FO + e and F(-) + H yields FH + e was undertaken using a drift tube to produce F(-) ions at various drift velocities and therefore different ion temperatures. Preliminary mobility measurements of F(-) ions in Ar were made, indicating that ion temperatures in the 300 K to 5000 K range could be achieved; however due to numerous difficulties experienced in obtaining a reliable F(-) ion source, the study could not be completed. Author

N72-16068*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT IMAGES PRODUCED BY X-RAYS USING THE NICKEL HYPOPHOSPHITE SYSTEM. 1: X-RAY SENSITIVE SALTS
Charles E. May, Warren H. Philipp, and Stanley J. Marsik Washington Feb. 1972 10 p refs
(NASA-TN-D-6651; E-6695) Avail: NTIS CSCL 07B

Twenty-eight crystalline salts were X-irradiated and treated with an ammoniacal nickel hypophosphite solution. Treatment (development) of six of the salts resulted in precipitation of nickel metal. The developable salts were four hypophosphites, sodium phosphite, and nickel formate. A mechanism is proposed for the process based on the postulate that micro amounts of hydrogen atoms are formed during the radiation step. During development, these hydrogen atoms cause the formation of nucleation sites of nickel metal. In turn, these sites catalyze further reduction of the nickel cations by the hypophosphite. The results are discussed in terms of application of the process to the formation of developable latent images. Author

N72-16069*# General Electric Co., Lynn, Mass. Aircraft Equipment Div.
SOLID POLYMER MEMBRANE PROGRAM Final Report
30 Nov. 1971 91 p refs
(Contract NAS9-11876)
(NASA-CR-115361; SPR-060) Avail: NTIS CSCL 07D

The results are presented for a solid polymer electrolyte fuel cell development program. Failure mechanism was identified and resolution of the mechanism experienced in small stack testing was demonstrated. The effect included laboratory analysis and evaluation of a matrix of configurations and operational variables for effects on the degree of hydrogen fluoride released from the cell and on the degree of blistering/delamination occurring in the reactant inlet areas of the cell and to correlate these conditions with cell life capabilities. The laboratory evaluation tests were run at conditions intended to accelerate the degradation of the solid polymer electrolyte in order to obtain relative evaluations as quick as possible. Evaluation of the resolutions for the identified failure mechanism in space shuttle configuration cell assemblies was achieved with the fabrication and life testing of two small stack buildups of four cell assemblies and eight cells each.
Author

N72-16070# National Research Council of Canada, Ottawa (Ontario).
MODERN ELECTROCHEMICAL METHODS OF ANALYZING SURFACE-ACTIVE AGENTS
H. Jehring 1971 14 p refs Transl. into ENGLISH from Abh. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. (East Germany), v. 6, 1966 p 197-207
(NRC-TT-1506) Avail: NTIS

Suitable methods, utilizing polarographic principles, of analyzing surface active agents through electrochemistry are examined. Methods include damping of polarographic maxima,

inhibition of polarographic currents, direct current methods, and alternating current methods. Results indicate damping maxima and inhibition techniques are the more sensitive and accurate of those investigated. E.H.W.

N72-16071# Purdue Univ., Lafayette, Ind. School of Materials Science and Metallurgical Engineering.
KINETICS OF DISSOLUTION OF Al IN Bi AND Zn IN Hg
T. L. Srikrishna, M. A. Dayananda, and R. E. Grace 1 Mar. 1971 17 p refs
(Contracts AT(11-1)-359; AT(11-1)-1436)
(COO-1436-29) Avail: NTIS

The kinetics of dissolution of rotating Al cylinders in liquid Bi and Zn single crystal disks in Hg were investigated under controlled hydrodynamic conditions, and solution rate constants were evaluated with the aid of the Nernst-Brunner relation. Dissolution of Al in Bi was studied in the temperature range from 300 to 600 C over the range of Reynolds numbers from 13,500 to 54,000; the experimental results obeyed the Eisenberg correlation and indicated a diffusion-controlled corrosion process. On the other hand, Zn single crystal disks dissolved in the geometry of a rotating disk in nearly-saturated Zn amalgams at 50 C showed that the rate of crystal attack was independent of hydrodynamic conditions in the range of Reynolds numbers from 20,000 to 30,000 and that the overall dissolution process was surface-controlled. Author

N72-16072# Bendix Corp., Kansas City, Mo. Dept. 814.
EVALUATION OF COMMERCIAL POLYARYL POLYISOCYANATES IN A BENDIX KANSAS CITY FOAM SYSTEM
J. Salary May 1971 35 p refs
(Contract AT(29-1)-613)
(BDX-613-508) Avail: NTIS

The effects of commercially available polyaryl polyisocyanates on Thermalthane 4003-8, a foam system, are discussed. The several tests performed on the rigid foam samples employing these compounds indicated Kaiser's NCO-20 to possess the best thermal stability at elevated temperatures. Author

N72-16073# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
COMPATIBILITY OF Zr-2.5 PERCENT Nb/Na AT 400 C
B. Henry 1970 14 p refs In FRENCH; ENGLISH summary
(EUR-4460F) Avail: AEC Depository Libraries

The oxidation and hydriding in sodium at 400 C of Zr-2.5% Nb samples cut from reactor pressure tubes were evaluated after treatment in a capsule for 1000 hr. The experiment was conducted with relatively impure sodium. In this environment it was found that the oxidation rate remains very low, and the hydriding rate is quite significant but may be drastically lowered by a pre-oxidation treatment of the zirconium alloy.
Author (NSA)

N72-16074# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
CHEMISTRY AND MATERIALS DIVISION Progress Report, 1 Jan. - 31 Mar. 1971
Mar. 1971 92 p refs
(AECL-3909; PR-CMA-16) Avail: AEC Depository Libraries; Atomic Energy of Can, Ltd., Chalk River: $2.00

Continuing research is reported on solid state physics, general and physical chemistry, and materials science. The research includes studies on diffusion in alloys and ceramics; radiation effects on solids and methods of analysis; analytical chemistry, radioactivity measurements, and electrochemistry; radiation and isotope chemistry; ceramics, surface chemistry, and metal physics; and university research. N.E.N.

N72-16075# Western Environmental Research Lab., Las Vegas, Nev.
SEPARATION TECHNIQUE FOR THE DETERMINATION OF Kr-85 IN THE ENVIRONMENT
D. L. Stevenson and F. B. Johns [1972] 11 p refs Presented at Intern. Symp. on Rapid Methods for Measuring Radioactivity in the Environment, Munich, W. Germany, 5 Jul. 1971 1971
(SWRHL-500-r; Conf-710705-5) Avail: NTIS

A carrier-free chromatographic method for separating krypton from an atmospheric sample is described. The krypton is then dissolved and counted in liquid scintillation solution. The method is comparatively simple, reproducible, and sensitive enough to routinely detect environmetnal levels of Kr-85. NSA

N72-16076# Illinois Univ., Urbana.
INTERNAL FRICTION IN THE NIOBIUM-HYDROGEN SYSTEM
Craig Carlton Baker Jun. 1971 109 p refs
(Contract AT(11-1)-1198)
(COO-1198-834) Avail: NTIS

The diffusional behavior of hydrogen in niobium was investigated in the temperature range 20 to 273 K using internal friction techniques. Relaxations due to two types of hydrogen complexes were observed: hydrogen pairs, and oxygen (or nitrogen)-hydrogen pairs. The hydrogen pair was shown to have an enthalpy of motion of 1265 cal/mole and an enthalpy of binding of 1490 cal/mole. The oxygen (or nitrogen)-hydrogen pair was shown to consist of a single hydrogen atom bound to the oxygen interstitial with an enthalpy of about 2000 cal/mole. The hydrogen motion enthalpy in the strain field of the oxygen atom was 3800 cal/mole. The cold work damping peak due to hydrogen moving in the strain field of a dislocation was observed and interpreted. Author (NSA)

N72-16077# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
PYROLYTIC CARBON INFILTRATION STUDIES
A. J. Taylor and R. Paluzelle 8 Sep. 1971 120 p
(Contract W-7405-Eng-26)
(Y-DA-2123-Rev-1) Avail: NTIS

Work done to produce and investigate both the conditions for successful infiltration and the characteristics of the deposited pyrocarbon is summarized. With the interest in pyC-infiltrated materials being related to inherently good ablation characteristics and, consequently, reentry vehicles, the scope of the work included an evaluation of techniqes for joining felt to form structures of closed geometry or, preferably, generating the means for obtaining or fabricating these structures without seams. Author (NSA)

N72-16078# Factory Mutual Research Corp., Norwood, Mass.
EVALUATION OF NOVEL SLURRY-TYPE FIRE EXTINGUISHING AGENTS Final Technical Report, 1 Mar. - 31 Jul. 1971
Joseph L. Buckley Sep. 1971 16 p refs
(Contract F33615-71-C-129916; AF Proj. 3048; Task-304808)
(AD-730610; RC71-T-31; AFAPL-TR-71-70) Avail: NTIS CSCL 13/12

An experimental program was conducted wherein mixtures of two fire suppressing agents, and a gelling agent (bromotrifluoromethane, CBrF3, ammonium dihydrogen phosphate (ADP) and Cab-O-Sil) were prepared as a potential suppressing agent for habitable aircraft interiors. These mixtures, although capable of extinguishing a combination class A and B fire, yielded a large quantity of particulates causing a high degree of obscuration and were, therefore, considered unsuitable for this application. A mixture of Halon 2402, ADP and Cab-O-Sil was prepared and found to be an excellent suppressing agent against the combination class A and B fire. This agent may be suitable for this application after certain toxicological questions are resolved.
Author (GRA)

N72-16079# Pennsylvania State Univ., University Park. Dept. of Materials Science.
A STUDY OF THE DISCHARGE OF POROUS Ag/Ag2O

ELECTRODES IN CONCENTRATED POTASSIUM HYDROXIDE ELECTROLYTE PhD. Thesis
E. G. Gagnon and L. G. Austin Sep. 1971 185 p refs
(Contract DAAG39-67-C-0065; DA Proj. 1T0-61102-A-34-A; HDL Proj. 96800)
(AD-732349; HDL-065-4) Avail: NTIS CSCL 07/4

The main objective of the work described was to develop an understanding of the electrochemical behavior of porous Ag/Ag2O battery electrodes operating at low temperatures in KOH solutions. The electrodes were fabricated using electroforming and pressed powder techniques. The temperature and conductivity of the electrolyte and some of the structural parameters of the pressed powder electrodes were varied, such as electrode thickness and porosity, relative amounts of Ag and AG2O, particle size of Ag, conductivity of the electrode, etc. A variety of steady- and unsteady-state electro chemical techniques involving galvanostatic, potentiostatic, and triangular voltage-sweep measurements were utilized. The voltage-current-temperature relationships obtained provided significant information regarding the ohmic, mass transfer, activation, and nucleation polarization effects observed. The discharge of porous Ag/AG2O electrodes at low temperature and high current densities was found to be complex and consisted of six separate voltage-time regions. It was also shown how the various structural parameters of the electrode and properties of the electrolyte affected the other five regions of the discharge curve. Author (GRA)

N72-16080# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
OXIDATION OF MERCAPTOBENZOTHIAZOLE TO BENZOTHIAZYL DISULFIDE IN COOLANT MEDIA Final Report
Jules B. Counts Sep. 1971 42 p refs
(DA Proj. 1T0-62105-A-109)
(AD-731789; CCL-294; AMCMS-Code-502Z.11.80300) Avail: NTIS CSCL 11/7

Higher concentrations of mercaptobenzothiazole (MBT) are required in coolants to inhibit corrosion of metals in cooling systems of higher horsepower engines against corrosion. Since thiols such as MBT are easily oxidized, the mechanism of this reaction and the contributing factors of light, oxygen, and heat are evaluated. It is demonstrated that MBT is readily oxidized to the less soluble, terminal molecule of benzothiazyl disulfide by way of free radicals, and that this conversion is irreversible in coolant media. The possibility of deleterious operational effect of this conversion is considered. Author (GRA)

N72-16081# Chemical Systems, Inc., Santa Ana, Calif.
CARBORANE POLYMERS
Robert E. Williams 1 Aug. 1971 33 p refs Presented at Intern. Meeting on Boron Compounds, Castle, Liblice, Czechoslovakia, Jun. 1970 Submitted for publication
(Contract N00014-70-C-0109)
(AD-732031; TR-8) Avail: NTIS CSCL 07/3

At present the most promising use for the various carboranes lies in incorporating them into polymers with the objective of building into the polymers special properties such as high temperature resistance and/or specialized chemical resistance. The carboranes, when incorporated into the backbone of silicone polymers, show especially interesting properties. Dexsil polymers based upon C2B10H12 are prime examples, and soon similar materials based upon the closo-carborane C2B5H7 will be available. One purpose of the report is to review in a cursory fashion examples of the numerous types of carborane-polymers which have been prepared and thus serve as the ackground upon which the more recent polymer progress has been achieved. Secondly, the budding field of C2B5H7 based polymers which are just now moving out of laboratory curiosity status and into commercial availability is covered. GRA

N72-16082# AeroChem Research Labs., Inc., Princeton, N.J.
KINETICS OF IRON AND ALUMINUM OXIDATION BY OXYGEN Annual Report, 1 Jun. 1970 - 31 May 1971
Arthur Fontijn and Shelby C. Kurzius Jul. 1971 33 p refs
(Contract DASA01-70-C-0152; ARPA Order 1433; NWER-Subtask-ZL433)
(AD-731414; AeroChem-TP-260; DNA-2735I; AR-1) Avail: NTIS CSCL 07/4

Because of the need for quantitative information on gaseous metal atom oxidation kinetics, an experimental research program has been initiated to determine the mechanism and rate coefficients of the homogeneous reactions of free Fe and Al atoms with O2. The apparatus used is a cylindrical fast-flow reactor, adapted for the study of the kinetics of refractory gaseous species at temperatures up to 1900 K. The Fe/O2 reaction at 1600 K was investigated in N2/O2 flows by observing the rate of decay of Fe-atom concentrations, measured in absorption, at pressures from 15 to 60 Torr. The gas phase reaction has been determined to be Fe - O2 yields FeO - O, with a rate coefficient k sub 2=4 x 10 to the minus 13 power ml/molecule/sec. This result is estimated to be accurate to within a factor of about 2. Evidence for heterogeneous oxidation of Fe in the presence of O2 has also been obtained; the lower limit for the probability of Fe oxidation per collision with the reactor wall, is found to be on the order of 1/10. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-16083 British Broadcasting Corp., Kingswood (England). Engineering Div.
THE PROPAGATION CONSTANT OF THE BEVERAGE AERIAL
P. Knight Oct. 1971 10 p refs
(BBC-1971/39; UDC-621.396.677.41; RA-88) Avail: BBC Kingswood Warren, Tadworth, Surrey, Engl.

The propagation constant for the current flowing in a Beverage aerial driven by a generator is derived from the compensation theorem. Comparison is made with measurements and with other theoretical methods. It is concluded that attenuation increases approximately as the square root of the frequency, reaching a limiting value at high frequencies. The velocity of propagation is less than the free space velocity but tends towards the latter at high frequencies. Expressions for the characteristic impedance of the aerial are also given. Author

N72-16084 British Broadcasting Corp., Kingswood (England). Engineering Div.
PULSE CODE MODULATION OF VIDEO SIGNALS: SUBJECTIVE STUDY OF CODING PARAMETERS
V. G. Devereux Oct. 1971 14 p refs
(BBC-1971/40; UDC-621.397; UDC-621.376.56; EL-57) Avail: BBC, Kingswood Warren, Tadworth, Surrey, Engl.

Subjective tests are described which were performed to establish the sampling rate and the number of bits per sample which should be used in a PCM system handling broadcast quality television pictures. These tests included an investigation of adding dither signals to the video signals prior to the PCM encoder as a means of reducing the required number of bits per sample. The effect of dither signals is to break up coherent quantizing errors, such as contouring effects, and replace them with less noticeable random quantizing errors. A theoretical estimate of the required number of bits per sample was derived by comparing calculated values of the magnitude of quantizing noise with the existing specification for random noise allowable on analogue links. Author

N72-16085# Advisory Group for Aerospace Research and Development, Paris (France).
PROPAGATION LIMITATIONS IN REMOTE SENSING

John B. Lomax, ed. (Stanford Res. Inst., Menlo Park, Calif.) Oct. 1971 424 p refs Presented at the 17th Symp. of the Electromagnetic Wave Propagation Panel of AGARD, Colorado Springs, Colo., 21-25 Jun. 1971 Original Contains Color Illustrations
(AGARD-CP-90-71) Avail: NTIS HC $6.00/MF $0.95

Theoretical and experimental performance analyses are reported for various remote sensing systems in order to develop their propagation ranges and suitabilities in relation to investigated media. Results cover the spectrum from optical to radio frequencies. For individual titles, see N72-16086 through N72-16119.

N72-16086# Army Engineer Topographic Labs., Fort Belvoir, Va.
A PROGRAM FOR THE DEVELOPMENT OF ADVANCED CAPABILITIES FOR COLLECTION, ANALYSIS, PRODUCTION AND DISSEMINATION OF MILITARY GEOGRAPHIC INTELLIGENCE **c13**
Kenneth R. Kothe *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 36 p (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

The objectives of the R&D program are identified as collection systems, data reduction systems and information systems. To improve data collection capabilities, work is described associated with sidelooking airborne radar and color multiband photographic systems. To improve the data reduction, research and development leading to automated image data extraction capability is reviewed. Then the development of a military geographic information system with an example output is outlined in relation to an overall concept. In conclusion, it appears the research and development objectives can be attained to implement the concept of operations in the 1985 time frame.
Author

N72-16087# Army Engineer Topographic Labs., Fort Belvoir, Va.
PROJECT SAND: REMOTE SENSING FOR ENGINEER CONSTRUCTION MATERIALS **c13**
Donald G. Orr and James R. Quick *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 17 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Remote sensor flights have been conducted over areas in the Mississippi Delta to determine the sensor configuration, analysis techniques, and diagnostic criteria for locating engineer construction materials under Project Sand. The sensor utilized included photography, thermal infrared, and sidelooking radar. In addition to the aerial imagery acquisition, ground measurements were made in each of the areas under investigation. The sensor imagery and ground truth data were analyzed by a team of experts in various earth science disciplines. The airborne operations and field data collection are described and a summary of the analyses results with unclassified illustrations are presented.
Author

N72-16088# Development and Resources Transportation Co., Silver Spring, Md.
AUTOMATIC PROCESSING OF ARCTIC PACK ICE DATA OBTAINED BY MEANS OF SUBMARINE SONAR AND OTHER REMOTE SENSING TECHNIQUES **c13**
Leonard A. LeSchack, William D. Hibler, III (Army Cold Reg. Res. and Eng. Lab., Hanover, N. H.), and Frederick H. Morse (Maryland Univ., College Park) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs Original Contains Color Illustrations (See N72-16085 07-07)
(Contract N00014-70-C-0110; NR Proj. 307-322)
Avail: NTIS HC $6.00/MF $0.95

Three remote sensors have been used for examining the upper and under surface of the Arctic ice pack; an upward looking sonar mounted on a nuclear submarine transiting beneath the ice, producing an under ice profile, a vertically mounted airborne laser, producing an upper ice surface profile, and an airborne infrared scanner in the 8-14 micron range, producing a heat picture of the ice surface. The sonar data were digitized and analyzed. Frequency distribution of amplitudes of the profile data indicates that young ice has a sharp, uni-modal distribution; older, more jumbled ice has a broad-based uni-modal distribution and old, much ridged ice has a bi-modal distribution. The same analytical techniques were used to process airborne laser profile data of pack ice. Analysis of profiles of multi-year ice and young ice show that the young ice has greater amplitude of all ridge spacings shorter than 20 m than does the multi-year ice. Airborne infrared scanning imagery of pack ice was color-contoured using a spatial data system. A simplified energy balance equation was used as a method to determine thickness of ice scanned.
Author

N72-16089# Communications Research Centre, Ottawa (Ontario).
THEORY AND FIELD TESTS OF A MICROWAVE RADIOMETER FOR DETERMINING SEA ICE THICKNESS **c14**
A. W. Adey *In* AGARD Propagation Limitations in Remote sensing Oct. 1971 10 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

A theoretical analysis of UHF emissions from sea ice and/or sea water is outlined. A radiometer system designed to observe these emissions operating at frequencies from 400 MHz to 1.5 GHz has been designed and built. The results of initial ground based and airborne tests of this instrument are presented. Initial results tend to confirm the theoretical analysis and predictions.
Author

N72-16090# Kansas Univ., Lawrence. Remote Sensing Lab.
RADAR IMAGING APPLICATIONS: PAST, PRESENT, AND FUTURE
Richard K. Moore *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Some of the proven applications of radar are outlined and future applications are suggested. Although restricted mostly to imaging systems, brief mention is made of the application of non-imaging radars to determining wind speeds over the oceans. Applications to be include: geology, geography, hydrology, bio-geography (including agriculture), oceanography, and cartography.
Author

N72-16091# Louisiana State Univ., Baton Rouge. Dept. of Geography and Anthropology.
CUMULATIVE FREQUENCY CURVES OF THE DARIEN PROVINCE, PANAMA
Anthony J. Lewis and William Waite (Arkansas Univ.) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Histograms and cumulative frequency curves of terrain slope are important in the quantitative description of geomorphic regions and aid in the study of land utilization and terrain mobility. Recently a method for obtaining such terrain slope information from radar imagery was developed utilizing the necessary relationship between terrain slope and the depression angle for the occurrence of radar shadows and the variation in depression angle from near to far range across the radar image. The characteristic shape of the cumulative frequency curves for four general geomorphic regions in Panama--plains, low hills, high hills, and mountains--proved diagnostic and substantiated both the qualitative geomorphic boundaries and the quantitative slope data determined from radar imagery. Only quantitative regional slope information is available for the poorly mapped Darien area in Panama.
Author

N72-16092*# Kansas Univ., Lawrence. Dept. of Geography.
VEGETATION MAPPING WITH SIDE LOOKING AIRBORNE RADAR: YELLOWSTONE NATIONAL PARK **c13**

Norman E. Hardy, Jerry C. Coiner, and William O. Lockman *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-16085 07-07)
(Contract NAS9-10261)
(NASA-CR-125451) Avail: NTIS HC $6.00/MF $0.95 CSCL 08B

The purpose of this study is to delimit the vegetation communities of Yellowstone National Park to the greatest extent possible by interpreting SLAR imagery and to identify factors which could be modified or controlled to enhance information content for any future SLAR vegetation mapping projects. The interpretation approach to the SLAR imagery was first to define the boundaries of the vegetation communities. After boundary definition, a classification of vegetation types was established based upon elevations, moisture and slope features evident in the SLAR image. To assist in the classification of the vegetation communities, a matrix interpretation key was constructed. Comparison of the vegetation map developed from SLAR and that prepared from ground truth data points to the ability of an active microwave image to provide vegetation information at the community level. Author

N72-16093# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE RADAR BACKSCATTER OF VEGETATION
G. P. deLoor and A. A. Jurrieens *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

To study the possible use of image tone in SLAR imagery for inventory purposes, a series of measurements were performed at X-band (and some at Ka-band) on the backscatter coefficients of single fields in an agricultural area through a complete growing season. Use was made of a stable platform with the radar at an altitude of 75 m above the terrain. The influence of the weather on the backscatter coefficient is studied by comparing the measurements with the output of an automatic weather station. Author

N72-16094# Naval Research Lab., Washington, D.C. Hulburt (E. O.) Center for Space Research.
WAVE HEIGHT MEASUREMENTS WITH A NANOSECOND RADAR
B. S. Yaplee, A. Shapiro, D. L. Hammond, and E. A. Uliana *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p ref (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

A radar system has been developed with a sufficiently narrow pulse width to resolve the vertical wave structure of ocean waves. The radar illuminates a 70 cm diameter spot on the ocean at normal incidence and three wave poles are placed in a delta configuration around the spot for ground truth measurements. A corner reflector is placed at the center of the antenna beam to calibrate radar measurements both in range and amplitude. Wind conditions are monitored using the tower's anemometer. These ground truths are then used in relating the radar measurements to actual sea conditions. The wave heights encountered range from two to six feet. Results of the radar measurements are presented and compared with simultaneous wave pole measurements of the sea surface structure. Author

N72-16095# Naval Research Lab., Washington, D.C.
REMOTE PASSIVE MICROWAVE MEASUREMENTS OF THE SEA SURFACE c13
James P. Hollinger *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

The important potential of all-weather determination of ocean surface wind fields by means of remote passive microwave sensing is discussed. The wind speed dependence of the microwave brightness temperature of the sea is interpreted as resulting primarily from small scale wave structure at wind speeds below about 15 to 20 m/sec and from the increasing coverage of sea foam at higher wind speeds. Measurements of these two effects are presented and the characteristics of each described separately. The two effects are combined to estimate the total microwave brightness temperature dependence of a wind driven sea as viewed from a satellite. Taken together the two effects allow the determination of ocean surface wind fields over the entire range of wind speeds. Author

N72-16096# Naval Research Lab., Washington, D.C.
REMOTE SENSING OF OCEAN EFFECTS WITH RADAR c13
N. W. Guinard *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 12 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Remote sensing of ocean surface effects is reported with the objective of evolving theoretical models of these effects to aid systems design and the acquisition of data in situ and in laboratory simulations to determine appropriate parametric relationships. The four-frequency radar system, a calibrated airborne measurement facility, has been extensively used for the in situ data collection. The radar is capable of operating sequentially on X band (8910 MHz), C band (4455 MHz), L band (1228 MHz), and P band/UHF (428 MHz) with both horizontal and vertical polarization. A review of the theoretical models and the parametric relationships is presented. In the course of the study, two new techniques for remotely sensing wave spectra have been evolved and used to obtain an explanation for the wavelength dependence of the sea return in low wind fields. Author

N72-16097# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
PROPAGATION EFFECTS ON MONITORING ATMOSPHERIC FINE STRUCTURE USING SIDE SCATTER ON APPROPRIATE FREQUENCIES
H. J. Albrecht and M. Piening *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

The possibilities of extending side-scatter analysis to higher frequencies are examined with regard to the very timely subject of monitoring air pollution above industrial areas, cities, and other exposed areas. The limits of detecting appropriate element sizes as well as the combination of such methods with turbulence analysis by side-scatter are considered for the purpose of estimating the degree of danger and its variation. Author

N72-16098# Fengler (C.), Hamburg (West Germany).
REMOTE SENSING AND ATMOSPHERIC LAYERS
C. Fengler *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Since absorption and scattering are well-known effects for the propagation limitations in remote sensing by electromagnetic waves refraction, reflection as well as ducting effected by atmospheric layers are considered. The reflection coefficient of Epstein profiles is treated in order to illustrate the effect of total reflection by grazing incidence. The deflection from a concentric layer of rays starting at the earth's surface and of rays coming from the outside of the earth is considered. The theoretical treatment is completed by presenting results of measurements of an earth - earth radio link as well as of a space - earth radio link evaulated under the aspect of the tropospheric layer structure. Author

N72-16099# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
ELECTROMAGNETIC SOUNDING OF ICE THICKNESS c13
C. R. Bentley and J. W. Clough *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See

N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

The efficiency of ice thickness determination in Antarctica and elsewhere has been vastly improved by the use of electromagnetic sounding. The electromagnetic sounder, which is basically a low-frequency radar system, is easily adapted to use in an aircraft, and is capable of measuring thicknesses of ice as great as 4 km. Since pure ice has an extremely low conductivity, electromagnetic wave propagation at a frequency of around 35 MHz is essentially non-dispersive. Absorption takes place in close accordance with the high-frequency tail of a Debye relaxation spectrum and is highly temperature dependent, the attenuation factor varying by 50-100 db/km over the range of temperatures (about 60 C) found in different glaciers. The attenuation in very cold ice is so small that it is substantially less than the normal spherical-spreading loss. Losses occurring at the reflecting boundary are about 10-20 db for most earth materials, but may be more if the boundary is rough. At a sharp ice-sea water boundary, however, the reflection loss is only 0.5 db.
Author

N72-16100# Army Engineer Topographic Labs., Fort Belvoir, Va.
A MATHEMATICAL ANALYSIS OF THE PROPAGATION AND REFLECTION OF PLANE ELECTROMAGNETIC WAVES IN A NONHOMOGENEOUS ISOTROPIC MEDIUM
Richard A. Hevenor *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Understanding of the propagation of electromagnetic waves in natural terrain surfaces can be aided by solving the vector wave equation for the case when the conductivity, the dielectric constant and the magnetic permeability are functions of soil depth. The problem to be analyzed is that of a nonhomogeneous half space where the conductivity and dielectric constant are arbitrary functions of depth. The basic approach employed is that of the geometrical optics solution of the wave equation. The final results yield expressions for the magnitude and phase of an electromagnetic field propagating in the nonhomogeneous medium for horizontal and vertical polarizations.
Author

N72-16101# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
REMOTE SENSING OF TROPOSPHERIC STRUCTURES USING HIGH RESOLUTION RADAR c13
J. H. Richter, E. E. Gossard, and D. R. Jensen *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

A very sensitive, ultra high resolution radar has been developed for the purpose of studying the refractive index structure of the troposphere. The radar is a ground based, vertically pointing FM-CW-radar with a range resolution of one meter. The radar and its performance characteristics are described. The radar routinely detects layer structures in the lower troposphere. These layers are always associated with gradients in the vertical refractive index profile, and are frequently very thin, approaching the resolution of the radar. Very often they are perturbed by wave motions. Examples of various wave patterns are presented.
Author

N72-16102# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
EFFECT OF BEAM WIDTH ON ACOUSTIC SIGNALS SCATTERED AT A ROUGH SURFACE
C. S. Clay and G. A. Sandness *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Underwater acoustic experiments were made in a laboratory tank in which the signals were scattered at a wind-blown surface. The rms roughness and spatial correlation function of the surface were measured by wave height probes. The ratio of the mean rectified signal scattered at the rough surface and that reflected at the smooth surface was measured for vertical incidence. Even though the surface was rough the mean rectified signal was inversely proportional to the source distance plus receiver distance. At large roughness the reflection-scattering function depends upon beam width and tends to the usual plane interface reflection function.
Author

N72-16103*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
INFRARED AND MULTISPECTRAL REMOTE SENSING c14
M. R. Holter *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs Original Contains Color Illustrations (See N72-16085 07-07)
(NASA-TM-X-67496) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

The history of infrared from its discovery in 1800 by Herschel is sketched. Recent advancements are described leading to modern infrared remote sensing devices. The performance of such devices is illustrated and future directions of development outlined. The recent extension of the infrared scanner to the multispectral sensing and pattern recognition system is described. Results from such systems are shown, limitations in their utility due to lack of understanding of signatures are described, and likely future developments are outlined.
Author

N72-16104# Electronique et de Physique Laboratoire d' Appliquees, Paris (France).
FUNDAMENTAL AND PRACTICAL LIMITS OF REMOTE INFRARED IMAGING INSTRUMENTS OPERATING BETWEEN 2, 5 AND 18 MICRONS c14
F. Desvignes *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 14 p refs In FRENCH; ENGLISH summary (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Main advantages of infrared radiation for remote sensing are outlined and the relations between space, time, and signal level resolving power of the instruments are considered in the propagation effects of signal attenuation and stray radiation. An analysis of the hypothesis and results of a computation of overall atmospheric transmittance for instruments using various types of detectors are given. This computation takes into account the absorption and diffusion by gases and aerosols in horizontal propagation, versus the distance.
Author

N72-16105# Lille Univ (France). Lab. d'Optique Atmospherique.
ANALYSIS OF RADIOMETRIC INFRARED SEA TEMPERATURE MEASUREMENTS c13
P. Y. Deschamps, P. Lecomte, and J. C. Vanhoutte *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs In FRENCH (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

Correction procedures are described that provide real temperature data for a sea surface from infrared radiometric measurements. The primary error source is reflection of sky radiation from the surface; it is corrected by real measurements at sea level. The secondary error is caused by transmission through the air layer between the radiometer and the sea; it is corrected theoretically. Above described corrections provide absolute temperature values for the sea surface with an accuracy of about 0.1 degree.
Transl. by G.G.

N72-16106# Lille Univ. (France). Lab. d'Optique Atmospherique.
ANALYSIS OF RADIOMETRIC INFRARED MEASUREMENTS ON CLOUD TEMPERATURES AND STRUCTURES c13
Y. Fouquart and J. Lenoble *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs In FRENCH (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

The angular distribution of radiation intensity in a cloudy atmosphere is studied by the 4.3 micron carbon absorption band. Evaluation of the observed spectral frequencies shows that radiation transmission depends on the optical thicknesses of cloud layers. Transl. by G.G.

N72-16107# National Environmental Satellite Center, Washington, D.C.

FACTORS AFFECTING THE ACCURACY OF SEA SURFACE TEMPERATURE MEASUREMENTS FROM ITOS-SR DATA **c13**

J. Leese, W. Pichel, B. Goddard, and R. Brower *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

The improved TIROS satellite sensor package contains a two channel scanning radiometer which operates in the .52- to .73-micron visible range and the 10.5- to 12.5-micron infrared water vapor window. One of the primary applications of the IR data is the operational determination of global sea-surface temperatures. The objective is to make statistically-integrated measurements, over areas approximately 100 km on a side, which agree with ground truth measurements within a root-mean-square deviation no larger than 1 C. A quantitative error analysis of the ITOS system, combined with tests on real data, shows that the objective should be reached using only IR data in regions where the magnitude of the temperature gradient is less than 2 C per 100 km. In regions where the temperature gradients are 2 to 4 C per 100 km the inclusion of SR data from the visible channel to reduce cloud contamination errors should place the accuracy objective within accessible limits. Author

N72-16108# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

ERBIUM LASER PROPAGATION IN A CO2 ATMOSPHERE IN THE NEAR INFRARED **c16**

Kenneth O. White, E. Howard Holt, Stuart A. Schleusener (New Mex. State Univ., Las Cruces), and Robert F. Calfee (NOAA, Boulder, Colo.) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

The transmission of laser energy in a carbon dioxide atmosphere has been measured in the 1.54 micrometers spectral region. An erbium laser was used which had two output emission regions in the eye-safe realm of the spectrum. The CO2 sample was contained in a pressure and temperature controlled, 20 m, White cell. The monitor and transmitter laser pulses were detected by germanium photodiodes and recorded on a dual parameter pulse-height analyzer which provided a real-time indication of the transmission and the quality of the data. A spectral scan over the laser output was obtained by sending a portion of the laser beam through a 3.3 m grating spectrometer which was preset to a narrow spectral region within one of the two output regions of the laser. The spectrometer was scanned over the laser output and the transmission obtained as a function of wavelength. Data and theoretical calculations are presented for a 480 m path length, a temperature of 30 C, and a CO2 pressure of one atmosphere. Author

N72-16109# Kansas Univ., Lawrence. Center for Research, Inc.

EFFECT OF ANGULAR VARIATION ON TERRAIN SPECTRAL REFLECTIVITY **c13**

Dwight D. Egbert and Fawwaz T. Ulaby *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)

(Contract DAAK02-68-C-0089)

Avail: NTIS HC $6.00/MF $0.95

A technique is described that determines the optimum filter combinations and the feasibility of multiband photography in the visible and near infrared regions in planning remote sensing missions. The test provides multispectral reflectivity curves not only for targets to be identified, but also for those backgrounds against which they are encountered. The procedure incorporates a method for determining spectral reflectance as a function of solar altitude, incidence look angle, and azimuth look angle. This angular dependence of reflectivity is significant and an aid in detecting certain targets. It was found that for one target-background pair (asphalt and grass) the contrast ratio ranges from 2:1 to 0.5:1 under different angle conditions. Author

N72-16110# Army Engineer Topographic Labs., Fort Belvoir, Va.

THE USE OF COLOR AERIAL PHOTOGRAPHY IN THE RECONNAISSANCE OF SOILS AND ROCKS **c14**

Abraham Anson *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

A specialized interpretation of soils and rocks can be obtained from aerial photography in color. In using aerial color film, the three-layer emulsion presents a more readily understood spectral relationship than can be obtained from black-and-white film; the reconnaissance of inaccessible areas with their rock structures is more rapidly analyzed than solely by ground exploration. Geologists analyze soil conditions using 1:20,000-scale aerial color and infrared photographs together with sparse generalized ground information. Author

N72-16111# Kansas Univ., Lawrence. Dept. of Geography.

AN ANALYSIS OF MULTISPECTRAL IMAGERY FOR TROPICAL LAND USE DISCRIMINATION **c13**

Roland D. Mower *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 16 p refs (See N72-16085 07-07)

(Contract DI-14-08-0001-12077)

Avail: NTIS HC $6.00/MF $0.95

Imagery data from a number of flight lines over Puerto Rico were analyzed to determine to what extent selected land use classes could be discriminated using conventional image interpretation techniques. The results were then compared with those obtained through use of a semi-automated densitometer/computer process. The semi-automated technique was also employed to determine which of the nine imagery channels (Ektachrome blue, green, red, and IR; multiband blue, green, red, and IR; and IR scanner) provides the best discrimination for each of the land use classes considered. A number of tentative conclusions were made regarding the relative performance of the imagery channels tested. Author

N72-16112# TRW Systems Group, Redondo Beach, Calif.

SEA BRIGHTNESS TEMPERATURES AT MICROWAVE FREQUENCIES **c13**

R. J. Wagner and P. J. Lynch *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 16 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

A complete geometrical optics theory of rough-surface emission and scattering is developed which accounts explicitly for surface shadowing effects and the contributions of double-scattered radiation. The validity of the emission theory is tested by comparing the results with a case for which the exact solution is known. A theorem is proved which establishes, for the domain of geometrical optics, the existence of rigorous upper and lower bounds to the effects of surface roughness on brightness temperatures; the Peake representation yields the upper bound provided shadow corrections, at least, are included, while an alternative representation provides the lower bound. Microwave brightness temperatures for the sea are calculated for a cylindrical roughness model. Double scatter contributions are shown to be apprecible and, with their inclusion, accurate calculation of brightness temperatures is possible. A model for a wind-driven spray layer is integrated into the theory and semi-emprical corrections for foam added; the results agree well with rough-sea data. Author

N72-16113# Air Force Cambridge Research Labs., Bedford, Mass.

STATISTICAL METHODS OF INDIRECT PROBING OF THE ATMOSPHERE c13

V. J. Falcone, Jr. and K. Mano *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

Three statistical methods for inversion of the radiative transfer equation (or any Fredholm integral equation of the first kind) are examined. For the microwave region of the electromagnetic spectrum the unknown function to be determined under the integral of the radiative transfer equation is the atmospheric temperature. Westwater and Strand determine the temperature profile by applying linear estimation theory. Tikhonov on the other hand assumes a smoothing functional which is minimized by the Euler-Lagrange equation. These two methods are shown to be equivalent when appropriate identification of terms is made, and where the regularization term of the smoothing functional is a linear differential operator. This equivalence is shown by use of Bayes estimation which is equivalent to the linear estimation theory, and in which the same functional form as the smoothing functional is minimized.

Author

N72-16114# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

IMAGE ANALYSIS BY MULTIPLEX CODING

Andre Girard *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 15 p refs In FRENCH; ENGLISH summary (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

An incohernet radiation distribution is analyzed by means of a system whose radiation transducer is a flux detector receiving incoming signals in a coded form. The coding presents the characters of a multiplex method; it ensures the optimum use of the available time to analyze the distribution under study, as the flux detector receives during the whole analysis time the radiation issued from all the elements of the space function. A gain in the signal/noise ratio is thus obtained as compared to direct analysis methods. The spectral range considered is in the infrared region. According to the first experimental results obtained, the use of pseudo-random, binary, cyclic codes seems the best in view of the practical advantages they offer. Author

N72-16115# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany).

AN APPLICATION OF THE MONTE CARLO METHOD TO REMOTE SENSING SYSTEMS c19

J. Roettger *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

The reliability of remote sensing systems, making use of electromagnetic wave propagation, is considerably influenced by propagation limitations due to the varying refractive index of the passed and sensed medium. Monte-Carlo-calculations, simulating an experiment by statistical computer mathematics, are carried out for ionospheric off-great-circle propagation on the transequatorial radio path Lindau/West Germany - Tsumeb/South West Africa. These calculations yield information about the error probability and reliability concerning the determination of sidereflection areas in the equatorial zone, using probability distributions of the parameters of ionospheric wave propagation. Statistical tests prove that the results, computed from remote measured data by means of a Monte-Carlo-technique, agree sufficiently well with direct measurements at the equator.

Author

N72-16116# Michigan State Univ., East Lansing.

TURBULENCE AND REFRACTIVITY CHANGES AND THEIR SENSING BASED UPON THE WAVE MECHANICS THEORY

M. Z. V. Krzywoblocki *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

Some methods of the quantum field theory in statistical physics are applied to a Bose type of medium fluid. The application of the wave mechanics theory to a spatial domain in a turbulent field is outlined and the propagation of waves in a turbulent medium is formulated by the Tatarski method. This is accompanied by a discussion of wave scattering in the turbulent atmosphere as well as of the influence of the turbulent field upon the magnitude and the variation of the refractive index for radio waves. Successful application of the concept of remote sensing to the status of atmospheric turbulence and refractivity variations is shown.

Author

N72-16117# Kansas Univ., Lawrence. Center for Research, Inc.

ON BACKSCATTERING FROM TWO SCALE ROUGH SURFACES

A. K. Fung and H. L. Chan *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-16085 07-07)

(Contract NAS1-10048)

(NASA-CR-125452) Avail: NTIS HC $6.00/MF $0.95 CSCL 20N

The two-scale composite rough surface model usually considered is one made up of large undulations over which small irregularities are superimposed. This general model may be further subdivided into two other models: (1) the large undulations are larger in dimension than that of the illuminated area so that within the beam of illumination the picture is a tilted perturbed plane; and (2) the large undulations are of such a size that at least several undulations can be found within the beam. The first model is essentially the small perturbation model. The second model is much more complicated; the contribution from the small irregularities may be computed by summing powers from the large facets constituting the large undulations. The total contribution from the composite surface is then taken to be that from the large undulations plus that from the small irregularities averaged over the large undulations. If the non-coherent assumption is not made, the total scattered field from the illuminated area must be computed before evaluating the power. This is the approach adopted by this paper to calculate both the vertically and horizontally polarized scattering coefficients.

Author

N72-16118# Wisconsin Univ., Madison. Dept. of Electrical Engineering.

THE IDENTIFICATION OF INHOMOGENEOUS MEDIA FROM TRANSIENT DIFFUSION OF ELECTROMAGNETIC FIELDS

J. N. Towle *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs (See N72-16085 07-07)

(Grants NSF GK-2311; NSF GK-21218)

Avail: NTIS HC $6.00/MF $0.95

For the purposes of magneto-telluric exploration the penetration of electromagnetic energy into the conducting strata presented by the earth's crust may be described by the parobolic equation of diffusion with a spatially dependent coefficient. A difference-differential solution to this equation is implemented on a hybrid computer and the resulting time dependent solutions are studied. Boundary conditions of the Neumann type, corresponding to the specification of magnetic field on the boundary, are appropriate for the determination of electric field in the conducting medium. The additional boundary conditions imposed by specification of electric field on the boundary provides the necessary information for the synthesis of a previously unknown conductivity profile.

Author

N72-16119# Kansas Univ., Lawrence.

WORKSHOP ON RADAR SCATTERING HELD TUESDAY AFTERNOON 22 JUNE 1971

R. K. Moore *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p (See N72-16085 07-07)

Avail: NTIS HC $6.00/MF $0.95

Three topics are discussed. Radar backscatter from the sea, the need for microwave data on dielectric properties of natural surfaces and objects, and slant-range measurements by the nanosecondpulse radar. The most significant conclusion to emerge is that insufficient data are available on the dielectric constants of natural materials (ice, vegetation, soil) measured in situ. Author

N72-16120# Institute for Telecommunication Sciences, Boulder, Colo.

HF SKY WAVE MEASUREMENTS AND PREDICTIONS

L. L. Proctor, D. D. Crombie, H. G. Sellery, L. L. Melanson, and B. C. Willmarth Jun. 1970 92 p

(ESSA-TR-ERL-170-ITS-108) Avail: SOD $1.00

Measurements for the month of April 1969 were made on a 2.666-MHz east-west path between Long Branch, Illinois, and Boulder, Colorado, to validate current ESSA/ITS prediction programs. The analysis determined the required transmitter power to produce a CW signal via the predominant mode which is 90 percent reliable and 12 db above the controlling noise. The averaged night values of required transmitter power including an 8-db correction factor found from the measured observations, are tabulated by month as a function of both the bearing and range. Author

N72-16121# Lockheed Missiles and Space Co., Palo Alto, Calif.

FUNDAMENTAL KINDS OF SHIPBOARD RADARS

V. V. Grigorin-Riabov, ed. [1972] 9 p refs transl. into ENGLISH from "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 542-554 p 542-554

Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A state-of-the-art review is made for various types of shipboard radars. Brief characteristics are presented for navigation radars to assure pilotage; radars to detect high flying aircraft; and radar stations to assure the entrance into, departure from, and maneuvering in ports, and the prevention of collisions between ships during poor weather conditions. A more extensive examination is made of radars to detect surface and low flying targets, and radars to detect ballistic missiles and artificial earth satellites. D.L.G.

N72-16122*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

A DIGITAL-TO-ANALOG CONVERSION CIRCUIT USING THIRD-ORDER POLYNOMIAL INTERPOLATION

William P. Dotson and Joe H. Wilson Washington Feb. 1972 62 p ref

(NASA-TR-R-382; MSC-S-272) Avail: NTIS CSCL 09F

Zero- and third-order digital-to-analog conversion techniques are described, and the theoretical error performances are compared. The design equations and procedures for constructing a third-order digital-to-analog converter by using analog design elements are presented. Both a zero- and a third-order digital-to-analog converter were built, and the performances are compared with various signal inputs. Author

N72-16123# Weapons Research Establishment, Adelaide (Australia).

THE CALCULATION OF IONOSPHERIC ABSORPTION IN HF RADIO PROPAGATION PREDICTIONS

P. L. George Aug. 1971 26 p refs

(WRE-TN-A207(AP)) Avail: NTIS

A survey and analysis of worldwide absorption data measured by the pulse method at vertical incidence has been used to establish the worldwide morphology of vertical incidence absorption. An accurate means for transforming this to oblique paths has been established. Application to the improvement of methods for estimating h.f. field strengths over oblique paths is described. Author

N72-16124# Engins Matra, Velizy (France).

UTILIZATION OF A SHUTTLE-TUG LAUNCHER FOR SPACE TELECOMMUNICATIONS MISSION OVER EUROPE

J. Durand 1971 22 p refs Presented at the 11th DGLR European Space Symp., Berlin, 24-26 May 1971

(D/APS/R210-399) Avail: NTIS

A space telecommunication mission over Europe is defined. How to fulfill the necessary requirements is analyzed, using conventional satellite and expendable launcher techniques. This baseline is compared to the reusable shuttle tug launcher. Technical and economical aspects and advantages are also considered. Author (ESRO)

N72-16125# Michigan State Univ., East Lansing. Div. of Engineering Research.

THE SHORT-BACKFIRE ANTENNA: A NUMERICAL-PHYSICAL OPTICS STUDY OF ITS CHARACTERISTICS Scientific Interim Report

Tsing-Zone Hsieh, Dennis P. Nyquist, and Kun-Mu Chen Jul. 1971 128 p refs

(Contract F19628-70-C-0072; Task-563505)

(AD-730615; AFCRL-71-0394; SR-2) Avail: NTIS CSCL 09/5

A numerical-physical optics method is applied to study the circuit (impedance) and radiation characteristics of the short-backfire antenna. This radiator, developed through extensive experimentation by AFCRL, consists of a dipole exciter located between a large rimmed reflector and a small secondary reflector. It has wide bandwidth and high directivity comparable to sophisticated reflector antennas. In the numerical-physical optics method, the following steps are followed: (1) a set of coupled integral equations for the currents excited in the dipole and on the surface of the secondary reflector are formulated and solved numerically, assuming for this step that the large reflector is infinite; (2) the surface currents of the large reflector are approximated by a truncated form of those calculated for the infinite conducting sheet; (3) the radiation field maintained by the currents of the steps (1) and (2) is calculated; and (4) a diffracted field correction is made to account for the finite dimensions of the large reflector and its rim. This method has the advantage, relative to earlier studies, that it can successfully predict the antenna's circuit characteristics. Excellent results are obtained for both square and circular geometries. Comparison is made with experimental measurements made by AFCRL. Author (GRA)

N72-16126# Naval Underwater Systems Center, Newport, R.I. Sonar Technology Dept.

A DISTORTIONLESS BEARING-FREQUENCY DISPLAY

Edward S. Eby and Maier O. Fein 13 Sep. 1971 25 p refs Presented at Sonar Display Symp., Washington, D. C., 26-27 May 1971

(NUSC Proj. B-044-00-00; Task-ZFXX-122-001)

(AD-731988; NUSC-4127) Avail: NTIS CSCL 17/1

The advantages of a distortionless bearing-frequency display for detection, localization, and classification are discussed. An overview of a signal-processing technique (Fourier transform processing) whose natural output is in this distortionless format is presented. Examples of this display derived from an optical Fourier processor for line arrays are shown. Areas of current and future developmental efforts for improving the line-array display are discussed. These areas include concepts for incoherent integration, display of a time-history, and computer-processed displays. Signal processing for planar and volumetric arrays require the development of techniques for displaying 3-, 4-, and 5- dimensional information. Author (GRA)

N72-16127# Naval Research Lab., Washington, D.C.

ARRAY BEAMFORMING RESPONSE STUDIES Interim Report

George W. Byram, George V. Olds, and Leon P. LaLumiere 14 Oct. 1971 24 p refs

(RF Proj. 05-552-403-4069)

(AD-732002; NRL-7331; NRL-S01-39) Avail: NTIS

CSCL 17/1

Computer graphics have been used to display the results of array beamformer computations in a form aiding insight into beamforming characteristics. In particular, the effect of a parameter such as frequency, wavefront curvature, beam angle, or shading on array response can be easily seen. The examples are chosen to illustrate those characteristics as well as to aid insight into a number of important array properties. The associated theory is briefly summarized with each example, and the emphasis on important array properties makes the report useful as a tutorial review. Author (GRA)

N72-16128# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

INFORMATION PROCESSING THROUGH VISUAL PERCEPTION AS A FUNCTION OF SIGNAL TO NOISE RATIO, BANDWIDTH, CONTRAST, AND TYPE OF NOISE ON A TELEVISION DISPLAY

Dorothy Mae Johnston 6 Oct. 1971 95 p refs
(Contract F44620-69-C-0033)
(AD-732311; AFOSR-71-2808TR) Avail: NTIS CSCL 17/2

To determine the optimum balances between signal-to-noise ratio and bandwidth for digital encoding television systems, a methodology was developed utilizing target identification in which man was considered as a receiver and processor of information presented on a display. A closed circuit television system and a three-dimensional simulated terrain were used to measure ten observers: responses on a target identification task. Two dependent variables (frame rate and probability of target identification) were used to assess the effects of the independent variables: bandwidth (0.5, 1, 2, and 3 mHz), signal-to-noise ratio (-12, -18, -24, and -30 db), contrast (33, 60, and 80 percent), and type of noise (random and weighted).
Author (GRA)

N72-16129# Naval Submarine Medical Center, Groton, Conn.

NAVY DIVER/SWIMMER VOCABULARIES: PHONEMIC INTELLIGIBILITY IN HYPERBARIC ENVIRONMENTS

Thomas Murry, Russell L. Sergeant, and Cynthia Angermeier 30 Dec. 1970 22 p refs
(Contract N00014-67-A-0197-0001; M Proj. 4306.03)
(AD-731981; NSMRL-648; NAVMED-M4306.03-2020D-02) Avail: NTIS CSCL 17/2

Data from several investigations of speech intelligibility under various diving conditions was evaluated in an attempt to better understand the existing problems of communication under water and in chambers by navy diving personnel. The paper compares data on the phonemic confusions found in diving environments with regard to their nature and severity and evaluates them in terms of the need to develop a new diving vocabulary. The data indicate that the sounds which are high in intelligibility in some environments are not in others. Moreover, the errors made at particular environments are not consistent over all conditions studied. From the point of view of maximum intelligibility of speech, the present analysis suggests that priority in the selection of words should be given to the specific phonemes that maintain their stability with increases in static pressure rather than to variations caused by the mixture of the breathing gas. A survey of available data indicates that minor changes in the phonemic structure of messages may provide increased intelligibility in the hyperbaric chamber and underwater environments. Author (GRA)

N72-16130# Aerospace Corp., El Segundo, Calif.

STABILITY, LINEARITY, AND OPTIMIZATION OF THE LINEAR FM SWEEP GENERATION LOOP FOR A 3.2 MM RADAR Research Report, Jan. - Feb. 1970

Walter A. Johnson 30 Aug. 1971 52 p refs
(Contract F04701-71-C-0172)
(AD-732203; TR-0172(2230-20)-8; SAMSO-TR-71-224) Avail: NTIS CSCL 17/9

The delay line discriminator phase lock loop used in the generation of the linear FM sweep for the 3.2-mm radar is analyzed, with emphasis on loop stability and the choice of the optimum delay for the delay line discriminator for various loop configurations. It is shown that a loop that does not employ a sampling detector is superior and that for such a loop the time delay should theoretically be made as small as possible. Some of the practical loop considerations that restrict the reduction of the time delay are discussed. Author (GRA)

N72-16131# Washington Univ., Seattle.

PARABOLIC TORUS REFELECTOR WITH CLUSTERED FEED FOR MULTIBEAM, HIGH GAIN, AND RAPID SCANNING OPERATIONS Interim Report

Stanley Lau-Po Wu and Akira Ishimaru May 1971 55 p refs
(Contract F19628-71-C-0112)
(AD-731760; AFCRL-71-0329; TR-145; SR-1) Avail: NTIS CSCL 17/9

There is a need for high gain antennas capable of multibeam or rapid scanning operations. The use of large arrays requires costly circuitry and large parabolic dish suffers from the aberration and mechanical inertia. An attractive compromise may be the combination of a large reflector and a small number of clustered feeds. This paper presents a study on the characteristics of a parabolic torus reflector. It has an advantage of small aperture blocking, but the scanning is limited to two dimensions. First, geometric optical method is used to determine the location of the optimum source surface which minimizes the source region. It is found that when the source is located at 0.58R where R is the radius of the circle generating the torus, over 90% of rays incident on the reflector is confined on the source surface within 1% of the reflector area. Next, the amplitude and phase distributions of the source field in the focal region are investigated using the geometric optics and the surface current integration. The radiation pattern is calculated using the conjugate field on the source surface. Uniform illumination and the Taylor's distribution are used and the first sidelobes are shown to be 16 db and 25 db respectively.
Author (GRA)

N72-16132# Washington Univ., Seattle. Dept. of Electrical Engineering.

DOUBLE SPHERICAL CASSEGRAIN REFLECTOR GEOMETRIC OPTICAL SOLUTION

Akira Ishimaru, Vincent K. Wong, and Ippalapalli Sreenivasiah Jun. 1971 35 p refs
(Contract F19628-71-C-0112; Task-460010)
(AD-731821; AFCRL-71-0381; SR-2; TR-146) Avail: NTIS CSCL 09/5

There is a need for high gain antennas which are capable of rapid scanning and multibeam operations. The report presents a study of double-spherical Cassegrain reflector to ascertain whether this antenna is practical for these purposes. The aperture blocking, the spread of the field, and the phase and amplitude distributions are examined using geometric optical technique. There is no single optimum condition, but it is shown that a proper combination of the subreflector and main reflector sizes and the position of the feed can indeed produce a promising antenna. Author (GRA)

N72-16133# Innsbruck Univ. (Austria). Electronics Lab.

CONSIDERATIONS ON THE CALIBRATION OF A FERRITE ROD ANTENNA FOR MEASUREMENTS

Norbert Nessler 5 Jun. 1971 17 p refs
(Contract F44620-71-C-0071; AF Proj. 4600-10-01)
(AD-731224; AFCRL-TR-71-0446; SR-1) Avail: NTIS CSCL 09/5

The described examination shows by experiment and in part also by theory that ferrite rod antennas for measurements in the RF-region up to about 1 MHz may be calibrated also at very short distances from the calibration transmitter coil. Inhomogeneity of the calibration field is compensated for by calculation. Disturbance of the primary field by the ferrite rod is determined and accounted for by a series of measurements. Author (GRA)

N72-16134# Singer Co., Pleasantville, N.Y. Kearfott Div.
HELIUM SPEECH INVESTIGATIONS Annual Technical Report, Jun. 1970 - May 1971
Robert A. Flower 30 Aug. 1971 18 p refs
(Contract N00014-70-C-0387; NR Proj. 145-242/3-17-70(454))
(AD-732035) Avail: NTIS CSCL 17/2

The basic objective of the work is to continue evaluations of and achieve further improvements in the Singer-Kearfott unscrambler technique. Investigations have shown that improvements result from using single polarity rather than bipolar pitch sync detection, and from excluding input signal components above 10 kHz. Simple compensation of the non-linear formant shift, and modification of the glottal wave decay rate produced no apparent improvement. A comparative evaluation of performance at the University of Florida was completed.
Author (GRA)

N72-16135# Stanford Research Inst., Menlo Park, Calif.
DISCRETE ECHOES IN IONOSPHERICALLY PROPAGATED GROUND BACKSCATTER Technical Report, May 1968 - Dec. 1970
Taylor W. Washburn Aug. 1971 132 p refs
(Contract N00014-70-C-0413; ARPA Order 1656; SRI Proj. 8727)
(AD-731704; TR-5) Avail: NTIS CSCL 20/14

Ionospherically propagated ground-backscatter signals in the 10-to-30-MHz frequency band have been used for decades as a means for studying the earth's ionosphere. Long pulse lengths and wide antenna beamwidths have resulted in backscatter echoes that were spatially averaged enough to give ambiguous information about the ionosphere. The purpose of this research is to explore experimentally how a backscatter sounder having high resolution in time delay (3 microsec) and in azimuth (1/2 deg) could be used to better measure ionospheric effects in backscatter signals. A pulse-compression waveform commonly referred to as sweep-frequency, continuous-wave (SFCW) modulation was used to achieve very short effective pulse lengths while allowing the transmitter to use a unity duty cycle. This waveform is very resistant to the effects of interference. A receiving-antenna azimuthal beamwidth of 1/2 deg was obtained through the use of an existing 2.5-km filled-aperture array of vertical monopoles. It is found that with a backscatter sounder having these characteristics, the spatial variations in ground-scatter coefficient are remarkably prominent in backscatter data.
Author (GRA)

N72-16136# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
LIMITATIONS IMPOSED ON THE RESOLUTION OF COHERENT RADAR SYSTEMS BY ATMOSPHERIC TURBULENCE
M. R. Wohlers Oct. 1971 40 p refs
(AD-731736; RM-520) Avail: NTIS CSCL 17/9

The resolution of a radar system or its ability to produce images showing fine detail of a target is limited by various factors. On the one hand there are deterministic factors such as the size of the antenna used in the system, and on the other hand there are random or nondeterministic factors such as the noise in the receiving system or the turbulence of the atmosphere that distort the electromagnetic waves propagating to and from the target. Up to the present the limitation imposed on the resolution of the radar system by atmospheric turbulence has not been a matter of great concern as the effects are generally small when the frequency of operation of the radar is in the lower portions of the microwave spectrum. However, when one considers a millimeter wave or optical wave radar, then the effects of atmospheric turbulence can become the dominant or controlling factor. This memorandum attempts to indicate the magnitude of the problem by finding the limitations imposed by atmospheric turbulence or those radar systems that function by sensing the angle-of-arrival of the return signal from the target.
Author (GRA)

N72-16137# Denver Research Inst., Colo. Electronics Div.
PROPAGATION TRANSFER FUNCTIONS Final Technical Report, 1 Jul. 1970 - 30 Jun. 1971
Ross W. Buchanan 15 Sep. 1971 34 p
(Contract F33657-69-C-1029; ARPA Order 1371; AFTAC Proj. VT/9506/F/ASD)
(AD-731737; DRI-2585; Program-Code-9F20) Avail: NTIS CSCL 14/2

The pulser appears to be a well built improved RES unit. The problems encountered were easily solved, and the unit has operated reliably since then. The repeatability of the radiated pulse has been found excellent. A pulse recording capability now exists and can be used to provide pulse output information as required. Present data are based on the assumption that the electrical characteristics of the B-DOT loop are determined entirely by its physical dimensions and therefore the loop is assured to be intrinsically calibrated. However, further effort is needed in the study of the loop antenna monitoring scheme to determine the accuracy with which the radiated free space field can be recorded and to determine what modifications in pulse shape, if any, arise from propagation effects and the sensor. In addition there should be a greater effort to define the pulse at higher elevation angles. Once these problems have been resolved it will be feasible to use the EMP simulator experimentally to determine system response functions with assured accuracy and reliability.
Author (GRA)

N72-16138# Mitre Corp., Bedford, Mass.
A SUMMARY OF SPECTRUM UTILIZATION AND A FREQUENCY ALLOCATION PLAN FOR THE INTEGRATED COMMUNICATIONS NAVIGATION IDENTIFICATION (CNI) SYSTEM
J. Clapper, Jr. Aug. 1971 81 p refs
(Contract F19628-71-C-0002; AF Proj. 6910)
(AD-731751; MTR-2063; ESD-TR-71-235) Avail: NTIS CSCL 20/14

Utilization of the radio frequency spectrum from 108 MHz to 1660 MHz for airborne radio navigation, air traffic control, and related communications and identification (CNI) purposes is examined with a view to identifying the most appropriate course of action to be followed in obtaining radio frequency allocations. On the basis of political, economic and electromagnetic compatibility considerations, combined with the necessity for the evolutionary introduction of CNI, an initial decision to concentrate TACAN operations on a lesser number of channels and reassigning the vacated spectrum space to CNI appears feasible in the 960-1215 MHz Aeronautical Radionavigation band. The 1535 MHz 1660 MHz portion of the spectrum appears attractive for an ultimate consolidation of space/aeronautical mobile and CNI concepts. Formal frequency allocation action at the United States national level to support these judgments is urged.
Author (GRA)

N72-16139# General Motors Corp., Goleta, Calif. Delco Electronics Div.
REMOTE AUTOMATIC MULTIPURPOSE STATION Quarterly Report
Oct. 1971 19 p refs
(Contract N00014-71-C-0357; ARPA Order 1783; NR Proj. 307-340)
(AD-732022; TR-1) Avail: NTIS CSCL 09/6

The report describes the Remote Automatic Multipurpose Station (RAMS) which was established to provide remote sensing of oceanographic and meteorological data in the Arctic regions.
GRA

N72-16241# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE RECEIVING OF VLF TIME SIGNALS
Klemens Nottarp *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 29-31 refs (See N72-16236 07-13)
Avail: NTIS

N72-16188# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SIX-CHANNEL ANALOG RECORDER [SECHS-KANAL-ANALOGSPEICHER]
J. Rehder *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 6 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

N72-16191# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
GENERATOR FOR REPRODUCIBLE QUASI-STOCHASTIC NOISE SIGNALS [GENERATOR FUER REPRODUZIERBARE QUASI-STOCHASTISCHE RAUSCHSIGNALE]
K.-D. Schulz-Helbach *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 13 p refs In GERMAN (See N72-16185 07-11)
Avail: NTIS

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N72-16140# Joint Publications Research Service, Washington, D.C.
AUTOMATIC GRAPHIC INPUT INTO COMPUTERS
G. Ye. Pukhov, I. D. Mayergoyz, A. F. Katkov, and V. I. Gumenyuk-Sychevskiy 23 Dec. 1971 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSP (USSR), v. 200, nos. 1 and 2, 1971
(JPRS-54788) Avail: NTIS

A theoretical and methodological analysis is made of a class of devices used for the automatic input of graphic information into electronic computers. Emphasis is placed on the development of techniques to overcome the inherent weaknesses and error producing mechanisms associated with the devices. For individual titles, see N72-16141 through N72-16142.

N72-16141# Joint Publications Research Service, Washington, D.C.
ON THE THEORY OF A CLASS OF DEVICES FOR AUTOMATIC INPUT OF GRAPHIC INFORMATION INTO ELECTRONIC COMPUTERS
In its Autom. Graphic Input into Computers 23 Dec. 1971 p 1-5 refs (See N72-16140 07-08)
(CSO-0829/72-W) Avail: NTIS

The devices considered are those based on the principle of modeling on conducting sheets through the voltage distributions of known and simple structure. Of particular interest, is the two-cycle type in which approximately homogeneous electrical fields are set up in a square conducting sheet in two mutually perpendicular directions. With the aid of an electron pen, the voltages approximately proportional to the x and y coordinates are measured and applied to the computer and indicator device. It is pointed out that several weaknesses of this type of equipment can be attributed to the inability to achieve a model of a two-coordinate potentiometer on the basis of a conducting square. In order to overcome these deficiencies, a model is developed which adopts a broader and more general principle as a basis for the device. D.L.G.

N72-16142# Joint Publications Research Service, Washington, D.C.
A METHOD FOR THE AUTOMATIC INPUT OF GRAPHIC INFORMATION INTO ELECTRONIC COMPUTERS
In its Autom. Graphic Input into Computers 23 Dec. 1971 p 6-9 refs (See N72-16140 07-08)
(UDC-681.325.021; CSO-0830/72-W) Avail: NTIS

An error elimination method is proposed for the two-cycle type devices used for the automatic input of graphic information into electronic computers. It is pointed out that with this type of device, outlining on the conducting surface is accomplished by a measuring electron pen. Since the pen is in motion while outlining, the stresses measured by it at each cycle correspond not to a single point, but rather to two distinct points of contact, and this leads to a certain error. The method proposed to overcome this difficulty involves using a current-carrying pen rather than the measuring electron pen. A model is presented which illustrates the function carried out by a device operating with the proposed modification. D.L.G.

N72-16143*# North American Rockwell Corp., Anaheim, Calif. Electronics Group.
VOTER-COMPARATOR-SWITCH OPTIMIZATION STUDY Final Report, 4 May 1971 - 3 Jan. 1972
J. Jurison 3 Jan. 1971 134 p refs
(Contract NAS9-11835)
(NASA-CR-118353; C71-1065/401) Avail: NTIS CSCL 09B

The design optimization and simulation effort of the voter-comparator switch (VCS) element are described. The VCS is an adaptive voter element that performs failure detection and reconfiguration function in a computer system designed to tolerate any three single failures in a fail operational fail operational fail safe manner. Detailed logic equations were developed and the design was evaluated and refined using a logic level fault simulator. Author

N72-16144*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A UNIVAC 1108 COMPUTER PROGRAM FOR USE WITH WORLDWIDE CLOUD COVER DISTRIBUTION DATA
Kirby D. Kyle Oct. 1971 35 p ref
(NASA-TM-X-58071) Avail: NTIS CSCL 09B

A computer program which implements the use of worldwide cloud-cover distribution data is discussed. This program was prepared for use on the NASA Manned Spacecraft Center Univac 1108 computer. Author

N72-16145*# Intermetrics, Inc., Cambridge, Mass.
CONTINUED ADVANCEMENT OF THE PROGRAMMING LANGUAGE HAL TO AN OPERATIONAL STATUS Final Report
30 Dec. 1971 142 p
(Contract NAS9-11944)
(NASA-CR-115367) Avail: NTIS CSCL 09B

The continued advancement of the programming language HAL to operational status is reported. It is demonstrated that the compiler itself can be written in HAL. A HAL-in-HAL experiment proves conclusively that HAL can be used successfully as a compiler implementation tool. Author

N72-16146*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INEXPENSIVE PROGRAMMABLE CLOCK FOR A 12-BIT COMPUTER
James E. Vrancik Washington Feb. 1972 13 p
(NASA-TM-X-2500; E-6589) Avail: NTIS CSCL 09B

An inexpensive programmable clock was built for a digital PDP-12 computer. The instruction list includes skip on flag; clear the flag, clear the clock, and stop the clock; and preset the counter with the contents of the accumulator and start the clock. The clock counts at a rate determined by an external oscillator and causes an interrupt and sets a flag when a 12-bit overflow occurs. An overflow can occur after 1 to 4096 counts. The clock can be built for a total parts cost of less than $100 including power supply and I/O connector. Slight modification can be made to permit its use on larger machines (16 bit, 24 bit, etc.) and logic level shifting can be made to make it compatible with any computer. Author

N72-16147# Joint Publications Research Service, Washington, D.C.
COMPUTER SIMULATION OF THE MOVEMENT OF A WALKING MACHINE
D. Ye. Okhotsimskiy, A. K. Platonov, G. K. Borovin, and I. I. Karpov 26 Jan. 1972 21 p refs Transl. into ENGLISH from "Modelirovaniye na TsVM Dvizheniya Shagayushchego Apparata" Moscow, Nauka Press, 1971
(JPRS-55025) Avail: NTIS

A study was made of a multilevel adaptive algorithm for controlling the motion of a six-legged automatic machine capable of moving over an uneven surface. The simulation is performed on a computer. The stylized picture of the movement of the machine over the terrain obtained on the display screen permits evaluation of the effectiveness of the proposed algorithms. Author

N72-16148*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STANDARDS GUIDE FOR SPACE AND EARTH SCIENCES COMPUTER SOFTWARE
G. Mason, R. Chapman, D. Klinglesmith, J. Linnekin, W. Putney, F. Shaffer, and R. Dapice Jan. 1972 33 p refs
(NASA-TM-X-65810; X-601-72-7) Avail: NTIS CSCL 09B

Guidelines for the preparation of systems analysis and programming work statements are presented. The data is geared toward the efficient administration of available monetary and equipment resources. Language standards and the application of good management techniques to software development are emphasized. E.H.W.

N72-16149# Brookhaven National Lab., Upton, N.Y.
REMEMBERING AS HUMANS DO: THE IMPACT OF ASSOCIATIVE COMPUTER MEMORIES
Arnold M. Peskin 21 Oct. 1970 9 p *Its* Brookhaven Lecture Ser. no. 96
(BNL-50287) Avail: NTIS

In the storage portion or memory of a conventional digital computer, information is generally searched and retrieved by specifying its location in the storage medium. It is also possible to find information by specifying some aspect of its contents or partial contents which is already known. Such a storage reference is possible with an associative or content-addressable memory is described. Implementation made use of the data communication facilities originally designed for Brooknet, observations were made which may exert influence on future computer designs, especially for those systems designed primarily to perform vector or matrix manipulations. Author

N72-16150# Badische Anilin- und Soda-Fabrik A. G., Ludwigshafen am Rhein (West Germany).
DOCUMENTATION ON CHEMICAL COMPOUNDS USING TOPOLOGICAL CODIFICATION AS AN EXAMPLE OF NEW COMPUTERIZED DOCUMENTATION PRINCIPLES
Ernst Meyer 1970 10 p refs In GERMAN Presented at the Deut. Dokumentartag 1970, Bad Reichenhall, West Ger., 14 Oct. 1970
Avail: NTIS

A topological structure coding is taken as an example to show that instead of a complex encoding a simple coding process can be used employing nonunitary code symbols. The code provides a means of reconstructing complex concepts for noise free information retrieval. This system can also be used with an uncontrolled vocabulary which is then converted by the computer into thesaurus terms. Examples are given of a combination of the new principles with older methods. ESRO

N72-16151# Badische Anilin- und Soda-Fabrik A. G., Ludwigshafen am Rhein (West Germany).
SCREENING
Ernst Meyer 1970 39 p refs Partly in ENGLISH and partly in GERMAN Presented at the Meeting of the Ges. Deut. Chem. on Inform. und Dokumentation in der Chem., Grosse Ledder, West Ger., 21-25 Sep. 1970
Avail: NTIS

A screening system was developed for information retrieval of large computerized chemical files. It allows for preselection of criteria divided into different facets and for linkages at several levels. It is claimed that the screening process saves computer time, provided a fixed word length is adopted. Examples are given using the GREMAS coding system. Some consideration is given to further development using parallel computers and associative registers for processing of queries. ESRO

N72-16152# European Space Operations Center, Darmstadt (West Germany). Information Handling Dept.
PRINCIPLES OF DATA PROCESSING FOR EXPERIMENTERS
H. G. Walter Oct. 1970 58 p refs
(ESOC-IN-91) Avail: NTIS

The processing of data for experimenters is primarily a mass production problem and is concerned with passing the raw telemetry data stream which arrives from the data acquisition stations at the central facilities through a multistage processing line under optimum conditions as regards the requisite equipment, quality assurance, completeness, and time delay. The end product is the processed data in some meaningful form with auxiliary data added which is significant for any subsequent data analysis under the experimenters' auspices. In describing the data processing activities by areas, emphasis is put on the technical and administrative organization of the individual areas which relay on both hardware devices and extensive computer software. Each of these areas represents a unit of an integrated data system, the nucleus of which is a large-scale general purpose computer. Author (ESRO)

N72-16153# Army Foreign Science and Technology Center, Charlottesville, Va.
THE CREATION OF A BRANCH FOR AN AUTOMATED SYSTEM OF MANAGEMENT (OASU) IN THE ENTERPRISES AND FACTORIES OF THE GUGK
P. A. Brykin and S. A. Kimel'man 22 Sep. 1971 12 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 3, 1970 p 68-72
(AD-732254; FSTC-HT-23-332-71) Avail: NTIS CSCL 08/2

In response to the requirements of the Main Administration for Geodesy and Cartography, since January 1969 the Economics Division of Central Scientific Research Institute of Geodesy, Aerial Photography, and Cartography has been working on developing a sector for an automated control. The basic purpose of this sector is to improve enterprise and factory management with the use of electronic computers and mathematical economic methods, by mechanicizing and automating the collection, transmission, processing, and storage of information and information dissemination, as well as by automating the control over fulfillment of decisions adopted. Author (GRA)

N72-16154# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DETERMINATION OF A SUFFICIENT STATISTICS IN THE PROBLEM OF THE RECOGNITION OF IMAGES SUBJECTED TO ADMISSIBLE TRANSFORMATIONS
L. Svyatogor 17 Aug. 1971 19 p refs Transl. into ENGLISH from the publ. Kibernetika i Vychislitelnaya Tekhnika Raspoznavaniye Obrazov' 1969 p 26-35
(Contract F33657-71-D-0057; DIA-Task-T71-05-09; DIA-Task-T71-05-13)
(AD-731911; FTD-HC-23-740-71) Avail: NTIS CSCL 09/4

The report discusses the solution of the problem of determining the sufficient statistics for classifying optical images in pattern recognition, using the concept of permissible transformations. The idea of permissible transformations consists of the fact that a set of images corresponding to one pattern in the absence of noise can be represented as specific transformations of a given standard reference image. The correlation recognition

algorithm is based on this concept; it calculates a set of correlation functions and its optimality is determined with the aid of sufficient statistics. The new statistics is called sufficient statistics. The present study shows that the conditional probability density function under specified conditions depends only on two factors: (1) the most probable value of the optical transformation parameter, and (2) the square of the distance between the initial image and the reference image.
Author (GRA)

N72-16155# Army Electronics Command, Fort Monmouth, N.J.
SYNTHESIS OF MONOGENIC ITERATIVE ARRAYS OF MACHINES
Edward Lieblein Jun. 1971 77 p refs
(Task-1H0-62101-A-327)
(AD-731470; ECOM-3429) Avail: NTIS CSCL 06/4

The monogenic tessellation automaton, a model for iterative arrays of finitestate machines, is studied from the synthesis viewpoint, Array design techiques are presented. The approach accommodates widely varying neighborhood interconnection shemes. Algorithms are given for the synthesis of arrays with respect to any given pattern sequence. Author (GRA)

N72-16156# Princeton Univ., N.J. Dept. of Electrical Engineering.
SENSITIVITY CONSIDERATIONS IN THE DESIGN OF LINEAR LEAST MEAN-SQUARED ERROR FILTERS
R. Lugannani and K. J. Liopiros Oct. 1971 7 p refs Prepared in cooperation with Aerospace Corp., Los Angeles
(Grant AF-AFOSR-1333-67; AF Proj. 9749)
(AD-732132; AFOSR-71-2641TR) Avail: NTIS CSCL 09/4

The usual approach to linear least mean-squared error filter design is concerned with minimizing a quadratic function of the error. Neglected in such an analysis is the effect that variations of the filter parameters may have upon the error criterion. In this paper the quadratic error term is combined with a suitable sensitivity measure to produce a new performance function, which is then minimized by selecting the appropriate linear filter. The resulting mean-squared error will be larger than the minimum error but less sensitive to parameter variations. To illustrate the advantages of this method, two specific examples are considered; both are concerned with estimating a random signal in white noise and exhibit a significant decrease in sensitivity with only a modest increase in mean-squared error.
Author (GRA)

N72-16157# Princeton Univ., N.J. Dept. of Electrical Engineering.
HEURISTIC PROGRAMMING APPLIED TO SCHEDULING MODELS
M. J. Krone Oct. 1971 5 p refs Prepared in cooperation with Yale Univ., New Haven, Conn.
(Contract DAHC04-69-C-0012; Grants AF-AFOSR-1333-67; NSF GP-579; AF Proj. 9749)
(AD-732131; AFOSR-71-2639TR) Avail: NTIS CSCL 12/2

Heuristic programming as used in the paper refers to a search technique having general applicability to combinatorial optimization problems. After describing the elements of a heuristic program, the author shows its application to two scheduling problems; namely, scheduling independent tasks on parallel processors, and the flow-shop problem. Author (GRA)

N72-16158# Illinois Univ., Urbana. Coordinated Science Lab.
COMPUTER BASED FOURIER PLANE TECHNIQUES FOR IMAGE PROCESSING
Tetsutaro Shibahara Aug. 1971 76 p refs
(Contract DAAB07-67-C-0199)
(AD-731480; R-522; UILU-ENG-71-2225) Avail: NTIS CSCL 09/2

In the past decades, picture processing has been developed in two ways: by means of Fourier optical techniques with optical image forming systems, and, following the development of computers, by means of modern data processing systems. The objective of this report is to combine these two approaches using computer techniques with the fast Fourier transform and spatial filtering, and thereby to perform picture processing in more efficient and effective ways. This work has been devoted especially to the problem of finding the boundaries of pictures, and to the character recognition problem. Author (GRA)

N72-16159# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYSIS OF THE RELIABILITY OF LOGIC CIRCUITS
N. P. Zhetbaeva and A. A. Loktionov 19 Jul. 1971 19 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Ser. Fiz.-Mat. Nauk (Alma-Ata), v. 8, no. 2, 1970 p 31-41
(Contract F33657-71-D-0057; DIA-Task-T71-05-09; DIA-Task-T71-05-13)
(AD-731904; FTD-HC-23-351-71) Avail: NTIS CSCL 09/2

The study of the reliability of logic circuits with series and parallel connected elements during random malfunctions is given. Generalized failure formulas are obtained for a trigger with a counting input and differentiating elements at the output, and an estimate is made of the reliability of the series circuit of the trigger. The result is compared with an estimate of the reliability of this same circuit obtained by taking catastrophic failures into account. A three input majority circuit with random malfunctions is considered, and generalized failure formulas are obtained for it. An estimate of the reliability of a majority circuit with random malfunctions is compared with an estimate obtained with allowance for catastrophic failures. It is found that in the case of both series and parallel connected elements substantially different results are obtained depending on whether the reliability is calculated with allowance for random malfunctions or catastrophic failures. Author (GRA)

N72-16787 McDonnell Aircraft Corp., St. Louis, Mo.
THE APPLICATION OF ANALOG TECHNIQUES TO REAL TIME ANALYSIS AND SCREENING OF DYNAMIC DATA
Roger C. Crites *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 55-61 (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16790 Arizona State Univ., Tempe.
THE ROLE OF LATENT INFORMATION IN INFORMATION PROCESSING IN MEASURING SYSTEMS
Peter K. Stein *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 31-107 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16844 TRW Systems Group, Redondo Beach, Calif.
DETERMINATION OF STRUCTURAL PROPERTIES FROM TEST DATA
A. E. Galef and D. L. Cronin *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 9-18 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16028# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
DATA ACQUISITION AT THE RESEARCH INSTITUTE FOR HUMAN FACTORS ENGINEERING [DATENERFASSUNG AM FORSCHUNGSINSTITUT FUER ANTHROPOTECHNIK]
K. R. Kimmel *In its* Human Factors Eng. 1970 p 69-74 In GERMAN (See N72-16019 07-05)
Avail: NTIS

N72-16189# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SIMPLIFIED FLIGHT DYNAMIC COMPUTER FOR A MANUALLY CONTROLLED RIGID WING AIRCRAFT [VEREINFACHTER FLUGDYNAMIKRECHNER FUER EIN MANUELL GELENKTES STARRFLUEGELFLUGZEUG]
P. Kuehne *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 13 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

N72-15966# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
PROGRAMMING OF A SIMULATION MODEL FOR EVALUATING THE RELIABILITY OF TECHNICAL SYSTEMS
F. Hammelrath *In its* Flight Mech. 1971 p 31-38 In GERMAN; ENGLISH summary (See N72-15963 07-02)
Avail: NTIS; DFVLR, Porz: 14,80 DM

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-16160# Sandia Labs., Albuquerque, N.Mex.
INSTALLATION OF ELECTRICAL LENGTH STANDARD AND CONSTRUCTION OF IMPROVED ELECTRICAL LENGTH BRIDGE
R. D. Moyer Aug. 1971 45 p refs Sponsored by AEC
(SC-DR-710384) Avail: NTIS

The measurement of intermediate values of the time delay encountered by an RF signal as it propagates through an unknown channel is reported. Work done to upgrade the overall measurement capability consist of: installation and analysis of a calculable standard of electrical length against which the measuring system may be checked, and improving the measuring system such that it may be calibrated by means independent of the standard and that measurements may be made through paths of higher insertion loss. Author

N72-16161# Institut Atomnoi Energii, Moscow (USSR).
PULSE GENERATOR OF MEGAVOLT CAPACITY
V. I. Mikhailov 1970 11 p refs In RUSSIAN
(IAE-1980) Avail: AEC Depository Libraries

A transformer with a sectioned core and a special commutated circuit was used as a generator of high voltage for accelerator tubes. Such an arrangement provides semisinusoidal voltage pulses with an amplitude of several megavolts. Experimental and calculated results are introduced and discussed. Author (NSA)

N72-16162# Royal Aircraft Establishment, Farnborough (England).
ANALYSIS AND REDUCTION OF HARMONICS AND FILTER WEIGHT IN AIRCRAFT-TYPE CYCLOCONVERTERS
G. W. Wilcock Dec. 1970 61 p refs
(RAE-TR-70250) Avail: NTIS

The operation of natural and forced commutation cycloconverters is described, and the harmonic spectra of their outputs determined. A simple method is developed for comparing the weights of harmonic filters required for either type of cycloconverter, and for determining the effect of design and operating parameters on filter weight. A claim, made elsewhere, that the filter weight of a naturally commutated cycloconverter may be reduced using negative feedback to eliminate harmonics, is assessed theoretically: negative feedback is shown to be relatively simple to apply and the claim valid. It is proposed that negative feedback be applied to reduce filter weight when forced commutation is used. A method for applying it to a forced commutation cycloconverter is described and analyzed. Author (ESRO)

N72-16163# Electric and Musical Industries, Ltd., Hayes (England). Research Labs.
A FEASIBILITY STUDY OF STORAGE IMAGING DETECTORS
D. J. Gibbons Paris ESRO Feb. 1971 97 p refs
(Contract ESTEC-1037/70)
(ESRO-CR-33) Avail: NTIS

A preliminary study is presented of an advanced storage imaging detector having properties appropriate to the various planned missions of the European Scientific Satellite Space Program. A theoretical study is made of those factors that determine the detectivity of an imaging device, and a critical survey is made of all devices allowing signal integration and slow scan mode of operation. Storage properties of the image are examined, with the aim of enabling a satellite-borne tape recorder to be dispensed. It is concluded that all missions can be performed by the same tube with slight variations to suit different functions. It is unlikely that a resolution of 100 line-pairs/mm would be achieved by electronic imaging, but a resolution of at least 50% modulation at 1000 points/diameter and a signal/noise ratio of 60db should be attainable in a tube about 116mm diameter capable of ruggedization. Author (ESRO)

N72-16164# Naval Research Lab., Washington, D.C.
VOLTAGE LEVEL AND WIRING WEIGHT FOR AIRCRAFT ELECTRICAL POWER SYSTEMS
6 Oct. 1971 30 p refs
(AD-732001; NRL-7298; NRL-E02-06) Avail: NTIS
CSCL 09/5

A method for computing the wiring weight, conductor weight, and conductor losses as a function of system voltage is described for aircraft electrical power systems. It is indicated that if phase voltage at the load is considered as system voltage then the number of wire conductors is equal to the number of phases. Hence, wiring weight, (I squared) R losses, and the number of conductors are directly proportional to the number of phases in a system and, for the same loads, the system voltage is inversely proportional to the number of phases. A 345-volt (three times the present 115-volt, three-phase voltage) single-phase system voltage would reduce the wiring weight, copper losses, and number of conductors to one-third their present value (on the three-phase ac system). A significant point, or criterion, for optimum system voltage is reached at a system voltage where the system wiring weight divided by system wiring losses is a minimum. Author (GRA)

N72-16165# Texas Univ., Austin. Electronics Research Center.
NARROW BANDWIDTH TRACKING FILTER
Inder Singh and E. L. Hixson 10 Mar. 1971 54 p refs
(Grant AF-AFOSR-1792-69; AF Proj. 4751)
(AD-732206-TM-26; AFOSR-71-1970TR) Avail: NTIS
CSCL 09/5

A narrow-bandwidth (plus or minus 5 Hz) tracking filter was designed and constructed to be used as an interface stage between the output of an electro-mechanical transducer and an automatic impedance computer. The system has two channels, one of which is used to filter voltages proportional to the force measured by the transducer and the second channel is used to filter voltages proportional to the velocity of the mechanical system as measured by the transducer, as the frequency of the excitation signal is varied from 10 Hz to 10 KHz. A filter is necessary to extract the signal which may be distorted by noise and system nonlinearities. The two-channel filter uses digital circuit techniques for simplicity, stability and reliability, yet it has a linear 80 db dynamic range for impedance measurements. The usefulness of the system is not limited to mechanical impedance measurements only. The system may be used to

obtain acoustic and electrical impedance and frequency response of other devices as well. Author (GRA)

N72-16166# Texas Instruments, Inc., Dallas. Central Research Labs.
RELIABILITY PHYSICS STUDY OF MICROWAVE, SOLID STATE DEVICES Final Report, 25 Mar. 1970 - 24 Mar. 1971
Turner E. Hasty, Truman G. Blocker, William R. Wisseman, and Ronald H. Cox Sep. 1971 76 p refs
(Contract F30602-70-C-0183)
(AD-731794; TI-08-71-35; RADC-TR-71-184) Avail: NTIS CSCL 09/1

The report covers the second half of a year-long study of the reliability physics of Gunn, LSA, and IMPATT devices. The major topics of discussion are thermal transport, failure mechanisms, and the results of life tests on Gunn, LSA, and IMPATT devices. Finally, an attempt is made to draw conclusions from these studies and to establish some acceptance criteria which should insure reliable performance of the bulk microwave devices. Author (GRA)

N72-16167# International Business Machines Corp., Oswego, N.Y. Electronics Systems Center.
DIELECTRIC MEMBRANE LIGHT VALVE STUDY Final Technical Report
Eugene T. Kozol, Harold H. Bloem, and Gary B. Laymon Griffiss AFB, N. Y. RADC Sep. 1971 150 p refs
(Contract F30602-70-C-0242; Job Order 55970002)
(AD-731776; RADC-TR-71-208) Avail: NTIS CSCL 09/1

The report presents a study of a dielectric membrane used as a light valve in a CRT. The areas of study included the schlieren optical system, the characteristics of the dielectric membrane; resolution, write and erase speed, and the storage capability of the composite membrane. It was shown that a thin dielectric substrate for electronic charge control and a corresponding elastomer (deformable) layer on the substrate with a suitable reference plane, provided many desirable features. The dielectric membranes were fabricated and tested successfully in demountable CRT. The resulting performance data was found to correlate with the analytical studies. Author (GRA)

N72-16168# General Electric Co., Schenectady, N.Y. Research and Development Center.
MANUFACTURING METHODS AND TECHNOLOGY FOR PROCESSING COBALT-SAMARIUM MAGNETS
Mark G. Benz AFML Wright-Patterson AFB, Ohio Jul. 1971 193 p refs
(Contract F33615-70-C-1098; AF Proj. 612-9A)
(AD-731820; S-71-1102; AFML-TR-71-142) Avail: NTIS CSCL 09/1

Alternative manufacturing methods, processes, and techniques for fabrication of cobalt-samarium magnets were evaluated. A pre-production pilot line capable of producing cobalt-samarium magnets was established. The properties of magnets produced on this pre-production pilot line exceed: (BH) sub max 15 MGOe, B sub r 8.2 kG, H sub c -6.5 kOe, H sub d (at B/H = -1/2) -5.0 kOe, and irreversible the loss (at B/H = -1/2) on exposure to 150C less than 10%. The cost of magnets produced on this pre-production pilot line was approximately one fourth the cost the same size magnet would be if fabricated from cobalt-platinum. Magnets produced on this pilot line were used to successfully fabricate five traveling wave tubes. The performance of these tubes indicates that cobalt-samarium magnets are suitable for fabrication of traveling waves tubes; and, in fact, that they will allow further advances in the state-of-the-art in the design of such tubes. Author (GRA)

N72-16169# Raytheon Co., Waltham, Mass. Microwave and Power Tube Div.
MANUFACTURING METHODS FOR SAMARIUM COBALT MAGNETS Final Report, 1 Dec. 1969 - 31 May 1971
Dilip K. Das, Albert Gale, D. Jonquin, A. Kelley, Leonard Lesensky, A. Paladino, W. Reid, P. Weihrauch, and E. Wettstein Wright-Patterson AFB, Ohio AFML Aug. 1971 153 p refs
(Contract f33615-70-C-1097; AF Proj. TE-9M-257/612-9)
(AD-731824; PT-3051; AFML-TR-71-151; IR-612-9B(F)) Avail: NTIS CSCL 09/1

Processes and techniques were established for the pilot line manufacturing of samarium-cobalt permanent magnets for use in high performance periodic permanent magnet focused traveling-wave tube amplifiers. The objective of achieving a capacity for 1000 magnets per month was exceeded. Typical properties of magnets produced in quantity are: energy product (BH max of 13 - 15 x 1,000,000 GOe, B sub r of 7800 plus or minus 200 Gauss, and Hc of 6800 plus or minus 300 Oe. Extensive measurements were made to establish temperature characteristics of second quadrant properties, long term stability, and maximum temperature use in an operating device. Irreversible temperature coefficients for magnetic properties up to 255C were found to depend linearly on demagnetizing field, whereas reversible temperature coefficients varied only slightly. Magnet rings assembled in a PPM stack (high demagnetizing factor) exhibited - 4% measurable change in peak axial field at 225C for over 900 hours. Device evaluation of magnets clearly established the superior performance possible with samarium-cobalt. Higher power and the attendant higher temperature are now achievable with TWTs. Author (GRA)

N72-16170# Texas Instruments, Inc., Dallas.
FAILURE MECHANISM STUDIES ON MULTILEVEL METALLIZATION SYSTEMS FOR LSI Final Technical Report, 20 May 1970 - 19 May 1971
P. B. Ghate Griffiss AFB, N.Y. RADC Sep. 1971 106 p refs
(Contract F30602-70-C-0214)
(AD-731796; TI-03-71-45; RADC-TR-71-186) Avail: NTIS CSCL 09/5

The objective of this investigation was the determination of quantitative information about the mechanisms of failure associated with aluminum-silicon dioxide-aluminum two-layer interconnection systems used on large scale integrated circuits. Author (GRA)

N72-16171# Sigmatron, Inc., Goleta, Calif.
RESEARCH ON AN INTEGRAL DISPLAY MEMORY Final Report
William J. Biter 13 Oct. 1971 72 p refs
(Contract N00014-71-C-0177; NR Proj. 215-168)
(AD-731746; Rept-1177-008) Avail: NTIS CSCL 09/5

The report investigates possible latching mechanisms which could be used to form a memory integral with a thin film electroluminescent display (LEF). Some of the various approaches were studied in detail to determine if the electro-optical characteristics of the LEF would make a difference in the expected performance of a latched display. It was found that the high value of capacitance and the sharp brightness vs. voltage relationship of the LEF reduced the requirements on the memory unit. However, more stringent requirements on fabrication techniques for the evaporated LEF indicated that the most practical approach would be an EL-PC feedback structure, with the PC being a photoconductor formed as a photosensitive powder. Author (GRA)

N72-16903 Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL DYNAMICS OF A PARABOLOIDAL ANTENNA
Myron L. Gossard and William B. Haile, Jr. *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 103-114 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16190# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SELECTED ELECTRONIC SWITCHING ELEMENTS [AUSGEWAEHLTE ELEKTRONISCHE SCHALTUNGSELEMENTE] SCHALTUNGSELEMENTE]
K.-P. Gaertner, K. Mueller, and J. Wernicke *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 10 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

N72-16192# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SWITCHING FOR ELECTRONIC SYMBOL GENERATION [SCHALTUNG ZUR ELEKTRONISCHEN SYMBOLERZEUGUNG]
K.-P. Gaertner, K.-D. Schulz-Helbach, and J. Wernicke *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 10 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-16172* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PHASE SHIFT CIRCUIT APPARATUS Patent
Gordon J. Deboo, inventor (to NASA) Issued 19 Oct. 1971 4 p Filed 21 Jul. 1970
(NASA-Case-ARC-10269-1; US-Patent-3,614,475; US-Patent-Appl-SN-56791; US-Patent-Class-307-262; US-Patent-Class-307-230; US-Patent-Class-328-155) Avail: US Patent Office CSCL 09C

A phase shifting circuit is described for selectively shifting the phase of an input signal from 0 to 180 deg. It is independent of signal frequency, and maintains constant signal amplitude. The circuit includes resistive and capacitive elements, a voltage variable impedance element, operational amplifier, and a phase detector. Official Gazette of the U.S. Patent Office

N72-16173# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND CONTROL THEORY
17 Dec. 1971 27 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 200, no. 5-6, 1971
(JPRS-54729) Avail: NTIS

The application of control theory for optimization of planning and scheduling systems is demonstrated. For individual titles, see N72-16174 through N72-16178.

N72-16174# Joint Publications Research Service, Washington, D.C.
ON THE STRUCTURE, CONTROLLABILITY, AND SYNTHESIS OF INVARIANT SYSTEMS
V. V. Velichenko *In its* Cybernetics and Control Theory 17 Dec. 1971 p 1-6 refs (See N72-16173 07-10)
(UDC-519.95; UDC-517.993) Avail: NTIS

Determinant equations are used to solve the problem of synthesizing invariant equations. Author

N72-16175# Joint Publications Research Service, Washington, D.C.
OPTIMIZATION IN THE THEORY OF MACHINES, USING THE LP-SEARCH METHOD
I. I. Artobolevskiy, M. D. Genkin, V. K. Grinkevich, I. M. Sobol, and R. B. Statnikov *In its* Cybernetics and Control Theory 17 Dec. 1971 p 7-11 refs (See N72-16173 07-10)
(UDC-518.1) Avail: NTIS

A statistical local search model is proposed as a nondimensional analog to the concepts machine, mechanism, design, etc. Optimum planning in series production and design of experiments includes both a search for a design plan according to given criteria and the formulation of a mathematical search analog. G.G.

N72-16176# Joint Publications Research Service, Washington, D.C.
ON THE PROPERTIES OF A FIELD OF EXTREMALS IN ONE CPTIMUM CONTROL PROBLEM
V. F. Illarionov and V. T. Pashintsev *In its* Cybernetics and Control Theory 17 Dec. 1971 p 12-15 refs (See N72-16173 07-10)
(UDC-519.95) Avail: NTIS

Pontryagin's maximum principle is used to establish the properties of the family of extremals in a plane, which are realized in the open area of a set of permissible values. The method is applied to the problem of determining the flight of an airplane over a given distance with a minimum expenditure of fuel. G.G.

N72-16177# Joint Publications Research Service, Washington, D.C.
ON THE REGULARIZATION OF THE BELLMAN METHOD IN PROBLEMS OF OPTIMUM RAPID ACTION
L. A. Kun and Yu. F. Pronozin *In its* Cybernetics and Control Theory 17 Dec. 1971 p 16-20 refs (See N72-16173 07-10)
(UDC-519.3:62-50) Avail: NTIS

The solution of an optimal control problem is reduced to locating an approximation from within of the initial control area of the canonical control area. It is demonstrated that in linear problems with conical control areas, the Bellman function and the synthesizing function are smooth. G.G.

N72-16178# Joint Publications Research Service, Washington, D.C.
CONTROL AND PREDICTION IN SCHEDULING THEORY PROBLEMS WITH INCOMPLETE INFORMATION
L. I. Feygin *In its* Cybernetics and Control Theory 17 Dec. 1971 p 21-26 refs (See N72-16173 07-10)
(UDC-519.95) Avail: NTIS

Construction of optimum schedules with random parameters in scheduling theory is discussed. The methods of statistical decision theory and dynamic programming are used in the investigation. Author

N72-16179*# Gaertner Research, Inc., Stamford, Conn.
ADVANCED MICROELECTRONICS RESEARCH FOR SPACE APPLICATIONS, PHASE 2 Final Report, 1 May 1970 - 31 Mar. 1971
W. W. Gaertner Mar. 1971 72 p refs
(Contract NAS5-21186)
(NASA-CR-122341) Avail: NTIS CSCL 09C

Negative-resistance circuits with possible space flight applications are discussed. The basic design approach is to use impedance rotation, i.e., the conversion from capacitance to negative resistance, and from resistance to inductance by the phase shift of the transistor current gain at high frequencies. The subjects discussed in detail are the following: hybrid fabrication of VHF and UHF negative-resistance stages with lumped passive elements; formulation of measurement techniques to characterize transistors and to extend the frequency of negative-resistance transistor amplifiers to higher microwave frequencies; and derivation of transistor characteristics required to increase the frequency range of negative-resistance transistor stages. Author

N72-16180# Kanner (Leo) Associates, Redwood City, Calif.
TEMPERATURE MEASUREMENT BASED ON THERMAL NOISE

Heinz G. Brixy [1971] 61 p refs Tranl. into ENGLISH from Kernforschungsanlage, Juelich, W. Ger. Inst. fuer Reaktorentwicklung, rept. JUL-635-RG Sponsored by AEC Prepared for LASL
(LA-TR-71-71; JUL-635-RG) Avail: NTIS

The Nyquist formula is used for determining the temperature. The noise voltage of two resistors are compared, the one at the unknown temperature, the other at room temperature. The ratio of the resistances, when the noise voltage from the two resistors are equal, determines the ratio of their absolute temperatures. Several temperatures are measured in the range from 300 K to 1100 K with an accuracy better than 0.2 percent. The noise thermometer is independent of the material from which it is made or its previous thermal and mechanical treatment. It is also independent of the environment like nuclear radiation and therefore especially suitable for temperature measurement in nuclear reactors. Author (NSA)

N72-16181# Texas Univ., Austin. Electronics Research Dept.
BIANNUAL OF ELECTRONICS RESEARCH NO. 13, PART 3 IN APLHA-IRON Final Scientific Report
Demetrios G. Lainiotis and Arwin A. Dougal 15 May 1971 379 p refs
(Grant AF-AFOSR-1792-69a; AF Proj. 4751; NR Proj. 039-089)
(AD-730632; JSEP-13-Pt-3; AFOSR-71-2021TR) Avail: NTIS HC $6.00/MF $0.95 CSCL 09/3

Research topics in progress, recent findings, and future plans in the areas of biomedical electronics; information systems; plasma and quantum electronics; solid state electronics; and acoustics and radio sciences are presented. Author (GRA)

N72-16182# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Electrophysics.
MICROWAVE NETWORK APPROACH TO GUIDED ACOUSTIC SURFACE WAVE STRUCTURES Final Report, 1 Jul. 1969 - 31 Dec. 1970
A. A. Oliner, R. C. M. Li, and H. L. Bertoni Aug. 1971 246 p refs
(Contract DAAB07-69-C-0418)
(AD-731866; PIBEP-71-092; ECOM-0418-F) Avail: NTIS CSCL 20/1

In addition to the formulation of a rigorous network approach to acoustic wave problems in solid and fluid media, equivalent networks have been derived for a large number of interfaces between different media. These networks are reported in a fashion which resembles a catalog of acoustic wave phenomena expressed in microwave network terms. These microwave network approaches were then applied to a variety of important current problems in microwave acoustics. One such problem is that of the step junction between plated and unplated regions of a substrate. An equivalent network has been derived for this step junction using a general theoretical approach for the approximate analysis of the network elements describing transverse discontinuities and junctions. The reflection and transmission properties of the step junction revealed some interesting features which served as the basis for several proposed novel devices, such as a narrowband in-line filter, a frequency selector, and a thickness monitor. Three structures were analyzed by means of the microwave network approach, and numerical results were obtained for the propagation characteristics. The results for the thin-ribbon and gap waveguides were compared with other available theoretical data and with available experimental information, and directional couplers for both of these guide types were analyzed. Author (GRA)

N72-16183# Mitre Corp., Bedford, Mass.
MICROWAVE SOLID STATE SOURCES AND INTEGRATED CIRCUITS Final Report
Bruce D. Campbell, Peter J. Benson, Alfred L. Murphy, Ved P. Nanda, and Ronald S. Steriti Jul. 1971 168 p refs
(Contract F19628-71-C-0002; AF Proj. 702B)
(AD-731756; MTR-2028; ESD-TR-71-229) Avail: NTIS CSCL 09/5

The report describes the completion of the studies, initiated in FY 69, carried out to assess the practicability of applying microwave integrated circuits and solid state fundamental oscillators to future sensor subsystems for radar and communications, including data relay. The X-band eight-element phased array was evaluated, a simple MIC module including a printed antenna was constructed and studies were carried out of avalanche diode oscillator modulation characteristics, MIC IMPATT avalanche diode oscillators, MIC antennas, and MIC evaluation techniques. Author (GRA)

N72-16184# Rice Univ., Houston, Tex. Aero-Astronautics Group.
GRADIENT METHODS IN OPTIMAL CONTROL THEORY
Angelo Miele Oct. 1971 43 p refs Presented at Intern. Advanced Summer School on the Impact of Optimization Theory on Technol. Design, Louvain, Belgium, 1971
(Grant AF-AFOSR-0828-67; AF Proj. 9749)
(AD-732242; AAR-98; AFOSR-71-2694TR; Rept-61102F; Rept-681304) Avail: NTIS CSCL 12/1

In the paper, recent work performed at Rice University on gradient methods in optimal control theory is presented from a unified point of view. The problem considered is that of minimizing a functional with respect to the state x(theta) and the control u(theta) which satisfy a vector differential constraint, a vector initial condition, and a vector final condition. The algorithms presented are two: the sequential gradient-restoration algorithm and the combined gradient-restoration algorithm.
Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-16185# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
CONTRIBUTIONS TO SIMULATION TECHNIQUES DURING 1968 [BEITRAEGE ZUR SIMULATIONSTECHNIK IM JAHRE 1968]
Feb. 1969 74 p refs In GERMAN
(Anthropotech-1/69) Avail: NTIS

Computerized approach and landing flight simulation, simulation interface and electronic switching for flight simulator C-11, and analog data recording for simulation devices are discussed. For individual titles, see N72-16186 through N72-16192.

N72-16186# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
STRUCTURAL CONCEPTION FOR A LANDING APPROACH VISUAL SIMULATOR USING THE INTERMEDIATE IMAGE PROJECTION METHOD [KONSTRUKTIVE KONZEPTION EINES LANDEANFLUG-SICHTSIMULATORS NACH DEM ZWISCHENBILD-PROJEKTIONSVERFAHREN]
K.-P. Gaertner and J. Wernicke *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 16 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

The visual information is provided by landscape photography onto a transparent material on which are reproduced the terrain features. The image of the relevant region is then projected through a vario-objective (zoom) on a display device as an intermediary image, which is then transmitted by a television system. The simulation of vertical motion is performed by varying

the focal length of the objective and simulation of forward motion of the aircraft relative to the ground by translating the transparent material. Simulation of any aircraft rotation is obtained by rotating the television camera. Values for the different parameters involved in the system are given and discussed. ESRO

N72-16187# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
VISUAL SIMULATION INTERFACE TO FLIGHT SIMULATOR C 11 [SICHTSIMULATIONS-INTERFACE ZUM FLUG-SIMULATOR C11]
P. Kuehne *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 2 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

The control of visual display devices in the C-11 instrument flight simulator required the introduction of location and flight mechanics data as electric signals. Potentiometers are used in connection with gears for rotating axes and amplitude, or phase comparison is used for pitch angle and velocity components. ESRO

N72-16188# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SIX-CHANNEL ANALOG RECORDER [SECHS-KANAL-ANALOGSPEICHER] c07
J. Rehder *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 6 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

It comprises a cassette-data recorder and an adaptive device for frequency modulation of the different channels. It is used for checking simulation programs. The operation modes for both recording and playback are explained. ESRO

N72-16189# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SIMPLIFIED FLIGHT DYNAMIC COMPUTER FOR A MANUALLY CONTROLLED RIGID WING AIRCRAFT [VEREINFACHTER FLUGDYNAMIKRECHNER FUER EIN MANUELL GELENKTES STARRFLUEGELFLUGZEUG] c08
P. Kuehne *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 13 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

An analog-hybrid, flight dynamic computer was designed to control visual display simulation and replace the C-11 flight simulator. It makes possible the simulation of flight conditions (acrobatics) that cannot be simulated by the C-11, allowing for parallel simulation with, and not dependent on the actual location of the C-11. ESRO

N72-16190# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SELECTED ELECTRONIC SWITCHING ELEMENTS [AUSGEWAEHLTE ELEKTRONISCHE SCHALTUNG-SELEMENTE] c09
K.-P. Gaertner, K. Mueller, and J. Wernicke *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 10 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

The design of a flight simulator required an electronic switching circuit with high stability and a power supply independant from impulse rate. Variation of the output potential by less than 5 times 0.0001 for variation of the main supply + or - 10% was needed. Switching was performed by an N channel field effect transistor. A direct current servo amplifier is also included. ESRO

N72-16191# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
GENERATOR FOR REPRODUCIBLE QUASI-STOCHASTIC NOISE SIGNALS [GENERATOR FUER REPRODUZIERBARE QUASI-STOCHASTISCHE RAUSCHSIGNALE] c07
K.-D. Schulz-Helbach *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 13 p refs In GERMAN (See N72-16185 07-11)
Avail: NTIS

Stochastic processes are achieved using power spectra, density distribution functions, and effective value. It is possible using a shift register to obtain binary signals with very long period which will show the same properties as binary stochastic processes. This process is discussed, and a statistical analysis of both output signals is presented. ESRO

N72-16192# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
SWITCHING FOR ELECTRONIC SYMBOL GENERATION [SCHALTUNG ZUR ELEKTRONISCHEN SYMBOLER-ZEUGUNG] c09
K.-P. Gaertner, K.-D. Schulz-Helbach, and J. Wernicke *In its* Contrib. to Simulation Tech. during 1968 Feb. 1969 10 p In GERMAN (See N72-16185 07-11)
Avail: NTIS

An electric symbol generator for displaying electric potential traces in X and Y directions on an oscilloscope is described. Symbol generation is based on hybrid-analog switching comprising two integrators for the X and the Y direction. The drawing of an image requires that individual elements are called for sequentially. ESRO

N72-16193# California Univ., Livermore. Lawrence Radiation Lab.
FACILITY FOR THE DETERMINATION OF LOW LEVEL TRITIUM IN BIOLOGICAL AND ENVIRONMENTAL SAMPLES
W. H. Hutchin, A. E. Bradley, E. M. Morimoto, W. Wadleigh, and E. Willes 22 Jul. 1971 10 p ref Presented at Tritium Symp., Las Vegas, Nev., 30 Aug. - 2 Sep. 1971; sponsored by PHS, Southwest Radiological Health Lab., and Nevada Univ. Sponsored by AEC
(UCRL-73128; Conf-710809-2) Avail: NTIS

A facility for the routine determination of low levels of tritium in biological and environmental samples has been established. Variations in the types of samples submitted and their tritium content necessitate a wide range of sample-preparation techniques. Among these are electrolytic enrichment, conversion of water to hydrogen gas, freeze drying, and combustion of organic matter to water. Liquid scintillation and internal gas proportional counting are the tritium measurement methods used. Detection limits may be enhanced by a factor of 75 when electrolytic enrichment is used. Routine analysis of samples having tritium levels as low as 1 TU are performed. Author (NSA)

N72-16194# Los Alamos Scientific Lab., N.Mex.
CHARGE-EXCHANGE METHOD OF PROTON INJECTION INTO ACCELERATORS AND ACCUMULATORS
G. I. Dimov Jun. 1971 28 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Novosibirsk Report IIF-304 Sponsored by AEC
(LA-TR-71-46; IIF-304) Avail: NTIS

Features of a charge exchange target for proton injection, development of sources of negative hydrogen ions, regions of application, comparison with the usual injection methods, and the density of protons in the phase space are discussed. Also, the status of the charge exchange method of proton injection is outlined. NSA

N72-16195# State Committee for the Utilization of Atomic Energy, Moscow (USSR).
ACCELERATORS IN MEDICINE, INDUSTRY, AND AGRICULTURE
E. G. Komar Jun. 1971 17 p Presented at the 4th Intern.

Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/442; Conf-710901-384) Avail: AEC Depository Libraries

Characteristics of various betatrons, electrostatic accelerators, and linear accelerators in the USSR for use in medicine, defectoscopy, activation analysis, development of new technological processes, increasing the productivity of agriculture, and other practical purposes are described. Author (NSA)

N72-16196# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
LARGE SCALE PRODUCTION OF Ac-227 AND DEVELOPMENT OF AN ISOTOPIC HEAT SOURCE FUELED WITH Ac_2O_3
L. H. Baetsle, P. Dejonghe, A. C. Demildt, M. J. Brabers (Louvain Univ., Belgium), A. DeTroyer (Union Miniere, Burssels, Belgium), A. Droissart, and M. Poskin (Union Miniere, Brussels, Belgium) May 1971 16 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/287; Conf-710901-106) Avail: AEC Depository Libraries

The irradiation devices and hot cell facilities including a radon absorption facility adapted for work with large quantities of Ra-226 and the resulting amounts of Ac-227 and Th-228 were completed and put into operation during the last quarter of 1969. The first irradiation took place in November 1969 and after several months of adaptation and improvement of the installation, routine production has now been started. A production of the order of 20 to 30 g Ac-227 per year is possible in the existing facilities in the near future. A double containment, during irradiation in BR2, is ensured by putting the welded capsules in an aluminum rig (thimble) connected to a suitable instrumented control panel. Three hot cells were fitted out with chemical equipment for precipitation, ion exchange techniques, and handling of oxide powders. Three other hot cells are installed to fabricate and test the heat source. A prototype heat source of 30 Watts to test fuel and capsule behavior and the venting system is now in preparation. Author (NSA)

N72-16197# Institute of Nuclear Sciences, Lower Hutt (New Zealand).
VALUE OF A LOW-ENERGY ACCELERATOR IN ADVANCING NUCLEAR TECHNOLOGY IN DEVELOPING COUNTRIES
G. J. McCallum May 1971 18 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/001; Conf-710901-365) Avail: AEC Depository Libraries

The use of a 3-MeV Van de Graaff accelerator in the nuclear research program in New Zealand is described. The research program is outlined and specific research including isotope production and charged particle activation analysis and related techniques are discussed. NSA

N72-16198# Los Alamos Scientific Lab., N.Mex.
LAMPF USERS HANDBOOK (PRELIMINARY VERSION)
Lewis E. Agnew, Jr. Jan. 1971 55 p refs
(Contract W-7405-Eng-36)
(LA-4586) Avail: NTIS

Descripitions of the LAMPF accelerator, experimental facilities and beams, and experimental equipment, accessories, and services are presented to provide the experimenter with the basic information to make a realistic research proposal at LAMPF. Author (NSA)

N72-16199# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
VIBRATION PROGRAMMER [PROGRAMMATEUR DE VIBRATIONS]
A. Coty 13 Sep. 1971 12 p In FRENCH
(LRBA-NT-20/71/DAF) Avail: NTIS

A proposal is made for the design of a vibration programmer capable of controlling a vibration generator within its limits of performance. A diagram of the required amplitude frequency function is fed to an optical reading device resulting in the issue of a signal via a gain controlled amplifier to the exciter. Output of the exciter is compared with the programmed value and any discrepancy results in feedback to the generator. ESRO

N72-16200# Tech Development, Inc., Dayton, Ohio.
SCALE MODEL PROPULSION SIMULATOR FOR SUPERSONIC AIRCRAFT Final Report, 1 Jul. 1969 - 1 Jun. 1971
William R. Moffitt Wright-Patterson AFB, Ohio AFAPL Aug. 1971 70 p
(Contract F33615-69-C-1909; AF Proj. 668A)
(AD-731238; AFAPL-TR-71-57) Avail: NTIS CSCL 21/5

The purpose of the program was to develop an engine simulator which will provide simultaneous simulation of the inlet and exhaust flow fields in a full span, supersonic aircraft wind tunnel model. The simulator was designed to match the engine characteristics of exhaust nozzle pressure ratio and nozzle flow function vs. inlet corrected airflow. This match will exist over the full mission profile of altitude and Mach number including the full reheat, full dry and part power dry operation. Aerodynamically, the unit consists of two basic elements: A four-stage axial flow compressor with no bleed provisions, pressure ratio - 2.8; A single-stage high pressure drive turbine. A portion of the turbine exhaust is throttled into the exhaust nozzle inlet and mixed with the compressor discharge flow to obtain the required exhaust flow. Temperature is not simulated in this model, but a hydrogen burner could be added at a later date. The limited compressor performance data obtained are summarized.
Author (GRA)

N72-16201# Army Engineer Topographic Labs., Fort Belvoir, Va.
UTILIZATION OF A PHOTOGRAMMETRIC FACILITY (PF) IN HUMAN ENGINEERING LABORATORIES BATTALION ARTILLERY TEST NUMBER TWO (HELBAT 2)
Richard E. Schneck Aug. 1971 33 p
(DA Proj. 4A6-62706-D-853)
(AD-731792; ETL-SR-71-2) Avail: NTIS CSCL 08/2

The report covers tests of the capability of photogrammetric equipment and techniques to provide positional data required by Field Artillery operations. Commercial grade photogrammetric equipment was assembled and installed by the U.S. Army Engineer Topographic Laboratories and was operated by enlisted personnel from the 30th Engineer Battalion (BT). The test was designed and implemented by the Human Engineering Laboratories in concert with an organizational readiness training test involving the First Armored Division Artillery at Fort Hood, Texas, during February 1971. Results of the total testing effort, Human Engineering Laboratories Battalion Artillery Test Number Two (HELBAT II), are reported in a separate document by the Human Engineering Laboratories, Aberdeen, Maryland. The high visibility given the concept, equipment, and operations of the Photogrammetric facility (PF) during HELBAT II resulted in subjective evaluation at all levels of command which was significant in the general acceptance of the PF's potential for military support. Sufficient data for numerical analysis were gathered only for Forward Observer and target positioning exercises, but other potential applications were examined. Test data indicate a 30% improvement in the capability to locate Forward Observers as compared with the doctrinal map-spot techniques, but a degradation in the ability to position targets was noted. Author (GRA)

N72-16202# Harry Diamond Labs., Washington, D.C.
HDL HOT CORE WIND TUNNEL
Frank T. Buckley, Jr. Aug. 1971 45 p refs
(DA Proj. 1S7-65801-M-613; HDL Proj. 49800)
(AD-732340; HDL-TM-71-2) Avail: NTIS CSCL 14/2

The Harry Diamond Laboratories Hot-Core Wind Tunnel is

an aerothermal test facility designed for use as a flight environment simulator for high-speed projectile fuzes, and as a research tool for the development of more reliable and economical fuze systems. A physical description of the facility is presented, its performance capabilities defined, and its simulation potential established. Author (GRA)

N72-16791 Bureau of Reclamation, Denver, Colo.
USBR VIBRATION TEST SYSTEM
R. M. McCafferty *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 109-117 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16792 Wyle Labs., Inc., Huntsville, Ala.
MULTI-DEGREE OF FREEDOM MOTION SIMULATOR SYSTEMS FOR TRANSPORTATION ENVIRONMENTS
T. K. DeClue, R. A. Arone, and C. E. Deckard *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 119-132 (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16793 State Univ. of New York at Buffalo.
DESIGN AND FABRICATION OF AN AIRCRAFT SEAT CRASH SIMULATOR
Nelson M. Isada *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 133-147 refs (See N72-16781 07-32)
(Grant EC-00287)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16795 Harry Diamond Labs., Washington, D.C.
ARTILLERY SIMULATOR FOR FUZE EVALUATION
H. D. Curchack *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 155-173 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16798 Sandia Labs., Albuquerque, N.Mex.
ISOTOPE FUEL IMPACT FACILITY
Larry O. Seamons *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 195-205 Sponsored by AEC (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16799 McDonnell Aircraft Corp., St. Louis, Mo.
A REVERBERATION CHAMBER FOR USE AT REDUCED PRESSURES
M. H. Hieken, J. N. Olson, and G. W. Olmsted *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 207-213 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16800 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
DESIGN OF AN OFF-ROAD VEHICLE MOTION SIMULATOR
Nelson M. Isada (State Univ. of N.Y., Buffalo), Robert C. Sugarman, and E. Donald Sussman *In* Shock and Vibration Inform. Center Shock and Vibration Bull., pt 3 Dec. 1970 p 215-222 (See N72-16781 07-32)
(Contract DAHC04-67-C-005; ARPA Order 841)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/set

N72-16801 Sandia Labs., Albuquerque, N.Mex.
AN AERIAL CABLE TEST FACILITY USING ROCKET POWER
C. G. Coalson *In* Shock and Vibration Inform. Center Shock and Vibration Bull., pt. 3 Dec. 1970 p 223-225 Sponsored by AEC (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16690# Centre d'Essais de Propulseurs, Saclay (France).
TEST METHODS AND EXAMPLES FROM THE PROPULSION TEST CENTER
Jean-Claude Ripoll and Jean-Bernard Cocheteux *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 17 p In FRENCH (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16427*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FIRE SAFETY DESIGN OF A MOBILE QUARANTINE FACILITY
Roderick S. Bass and John K. Hirasaki *In its* Conf. on Mater. for Improved Fire Safety 1971 p 151-154 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 14B

N72-16026# Forschungsinstitut fuer Anthropotechnik, Meckenheim (West Germany).
METHODS OF FLIGHT SIMULATION [VERFAHREN DER SICHTSIMULATION]
K.-P. Gaertner *In its* Human Factors Eng. 1970 p 50-58 In GERMAN (See N72-16019 07-05)
Avail: NTIS

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-16203 Scientific and Business Consultants, Inc., Atlanta, Ga.
THREE DIMENSIONAL TURBULENT BOUNDARY LAYERS
John F. Nash (Lockheed Georgia Co., Marietta) and Virendra C. Patel (Iowa Inst. of Hydraulic Res.) 1972 190 p refs
Copyright. Avail: Issuing Activity

The theoretical equations of three-dimensional turbulent boundary layers in steady, incompressible flow are developed and the approximations and limitations associated with their solutions are discussed. The fundamentals of the approximations, and extensions to two- and three-dimensional boundary layers are treated in detail. The present state-of-the-art in physical models, and integral and differential methods of calculation are described. Numerical computations are presented and compared with experimental data. N.E.N.

N72-16204*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE FROM TWO-DIMENSIONAL VORTICES

Newell D. Sanders and Norbert O. Stockman 1972 10 p refs Presented at the 10th Aerospace Sci. Meeting, San Diego, Calif., 17-19 Jan. 1972; sponsored by AIAA
(NASA-TM-X-67986; E-6719) Avail: NTIS CSCL 20D

The fluctuating flow in an idealized model of a turbulent shear layer composed of many discrete vortices is analyzed. Computer solutions reveal irregular motions which are similar in many respects to observed flows in turbulent three-dimensional layers. The model is further simplified to a pair of equal co-rotating vortices and the noise generation is analyzed in terms of equivalent quadrupole oscillations. Results of the analysis in a uniform medium are consistent with Lighthill's results. New results are obtained for the effects of mean velocity gradients, compressibility, temperature inhomogenities, and gradients of the mean Mach number. Author

N72-16205# National Aeronautical Establishment, Ottawa (Ontario). High Speed Aerodynamics Section.
HIGHER-ORDER THEORY OF TWO-DIMENSIONAL SUBSONIC WALL INTERFERENCE IN A PERFORATED WALL WIND TUNNEL
M. Mokry Oct. 1971 33 p refs
(LR-553; NRC-12370) Avail: NTIS

The analytic solution for the interference velocity potential due to a source and a vortex between perforated wind tunnel walls is extended to higher-order singularities. This allows a more accurate construction of the primary perturbation potential at the walls produced by the tested airfoil, and the evaluation of wall interference on the model involving terms of higher powers of the airfoil chord/tunnel height ratio. The solution for the interference velocity at the position of the model is presented in the form of a series expansion, with Bernoulli polynomials of a suitably chosen function of wall porosity as coefficients. This approach provides a unified theory of various correction factors for perforated walls. The discussion is limited to subsonic flow and a thin airfoil of small camber and incidence, placed midway between the perforated walls. Author

N72-16206*# Texas A&M Univ., College Station. Engineering Experiment Station.
HEAT ADDITION TO A SUBSONIC BOUNDARY LAYER: A PRELIMINARY ANALYTICAL STUDY
John M. Macha and David J. Norton Sep. 1971 43 p refs
(Contract NAS9-9766)
(NASA-CR-115358; TEES-1178-TR-71-01) Avail: NTIS CSCL 20D

A preliminary analytical study of the effects of heat addition to the subsonic boundary layer flow over a typical airfoil shape is presented. This phenomenon becomes of interest in the space shuttle mission since heat absorbed by the wing structure during re-entry will be rejected to the boundary layer during the subsequent low speed maneuvering and landing phase. A survey of existing literature and analytical solutions for both laminar and turbulent flow indicate that a heated surface generally destabilizes the boundary layer. Specifically, the boundary layer thickness is increased, the skin friction at the surface is decreased and the point of flow separation is moved forward. In addition, limited analytical results predict that the angle of attack at which a heated airfoil will stall is significantly less than the stall angle of an unheated wing. These effects could adversely affect the lift and drag, and thus the maneuvering capabilities of booster and orbiter shuttle vehicles. Author

N72-16207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LAMINARIZATION MODEL FOR TURBULENT EDDY TRANSPORT IN HIGHLY ACCELERATED NOZZLE TURBULENT BOUNDARY LAYERS
James F. Schmidt, Donald R. Boldman, and Carroll Todd Washington Feb. 1972 10 p refs
(NASA-TM-X-2501; E-6659) Avail: NTIS CSCL 20D

A laminarization model which consists of a completely laminar sublayer region near the wall and a turbulent wake region is developed for the turbulent eddy transport in accelerated turbulent boundary layers. This laminarization model is used in a differential boundary layer calculation which was applied to nozzle flows. The resulting theoretical velocity profiles are in good agreement with the experimental nozzle data in the convergent region. Author

N72-16208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT TRANSFER AND BOUNDARY LAYER IN CONICAL NOZZLES
Donald R. Boldman and Robert W. Graham Washington Feb. 1972 60 p refs
(NASA-TN-D-6594; E-6228) Avail: NTIS CSCL 20D

A review of a comprehensive experimental investigation of the heat transfer and boundary layer in 30 deg to 15 deg and 60 deg to 15 deg conical nozzles is presented. The experiments were conducted with air at a stagnation temperature of 539 K (970 R) and throat Reynolds numbers based on a diameter ranging from 6 x 10 to the 5th power to 5 x 10 to the 6th power. Nozzle wall surface finish was varied from a smooth machine finish to a 826 x 10 to the minus 6th power cm (325 x 10 to the minus 6th in.) rms sandblasted finish. Measured heat transfer and wall temperatures are tabulated. Author

N72-16209*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER PROGRAM FOR CALCULATING SUPERSONIC FLOW ABOUT CIRCULAR, ELLIPTIC, AND BIELLIPTIC CONES BY THE METHOD OF LINES
E. B. Klunker, Jerry C. South, Jr., and Ruby M. Davis Washington Feb. 1972 89 p refs
(NASA-TM-X-2437; L-7951) Avail: NTIS CSCL 20D

A user's manual for a computer program which calculates the supersonic flow about circular, elliptic, and bielliptic cones at incidence and elliptic cones at yaw by the method of lines is presented. The program is automated to compute a case from known or easily calculated solution by changing the parameters through a sequence of steps. It provides information including the shock shape, flow field, isentropic surface properties, entropy layer, and force coefficients. A description of the program operation, sample computations, and a FORTRAN 4 listing are presented. Author

N72-16210# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
CALCULATION OF INTERACTING TURBULENT SHEAR LAYERS: DUCT FLOW
P. Bradshaw, R. B. Dean, and D. M. McEligot (Ariz. Univ., Tucson) Jun. 1971 35 p refs Supported in part of Mobility Equip. Res. and Develop. Center, Ft. Belvoir, Va.
(IC-Aero-71-14) Avail: NTIS

The boundary layer calculation method of Bradshaw, Perriss and Atwell was adapted to deal with the interaction between two shear layers with a change of sign of shear stress. Good agreement with experiments in symmetrical duct flow is found, using the same empirical input as in a boundary layer and assuming that the turbulence fields on either side of the duct can be superposed. The restriction to symmetrical flow is temporary and is a numerical rather than a physical simplification. Suggestions are made for representation of the effects of interaction on the turbulence structure in cases where this may be necessary. Author

N72-16211# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STARTING CONDITIONS OF A MIXED COMPRESSION AXISYMMETRIC HYPERSONIC INLET
Gerard Laruelle and Jacky Leynaert 1971 9 p refs In FRENCH; ENGLISH summary Presented at the AGARD Meeting on Inlets and Exhaust of Aerospace Propulsion Systems, Sandefjord, Norway, 13-17 Sep. 1971

(ONERA-TP-977) Avail: NTIS

In a perfect fluid, the starting conditions of a mixed supersonic compression inlet are theoretically to be found in a configuration such that a normal shock occurs right at the entrance of the internal convergent section. However, tests indicate that this definition is not correct, due to a shock-boundary layer interaction process, and that the actual starting conditions are less strict than the computed ones. Therefore, an improved diagram including an elementary representation of the interaction phenomenon is used. By means of this diagram, test data on axisymmetrical inlets at high supersonic speeds are discussed.

Author

N72-16212# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.

AN APPLICATION OF THE METHOD OF SERIES TRUNCATION TO THE CONICAL FLOW PROBLEM

Fumio Tamaki, Motoki Hinada, and Masahiro Kurosaki Oct. 1971 30 p refs

(ISAS-469-Vol-36-11) Avail: NTIS

An application is presented of the method of series truncation to conical flow problem. Several flow fields around conical bodies without axial symmetry at supersonic speeds are solved approximately by this method. The numerical results are satisfactory. Knowledge about flow fields for various conical bodies having cross-sections of pseudoquadrangular, pseudo-triangular and lip-like shapes is obtained by the procedure of replacing the body surface by a streamline in the flow solved by the method of truncation.

Author

N72-16213# Scientific Translation Service, Ann Arbor, Mich.

RADIAL FLOW THROUGH A ONE-DIMENSIONAL GAS CENTRIFUGE

E. H. Hirschel [1971] 21 p refs Transl. into ENGLISH from Conf. Paper, Stroemungsmechanische Vorgaenge in Graszentrifugen, DFVLR-Kolloq., Porz-Wahn, W. Ger., 14 May 1970 p 121-145 Sponsored by AEC

(K-Trans-61-3; Conf-700557-7) Avail: NTIS

The radial flow of a compressible, two-component gas through a centrifuge was investigated with the use of a numerical solution of the Navier-Stokes equation for the nonstationary case and analytical solution for the case of small throughput with stationary flow. It was assumed that the gas had thermally ideal characteristics and that dilution effects were small in the internal part of the centrifuge, so that adhesion conditions could be expected on the internal cylinder. The internal degrees of freedom of the gas molecule were considered to be in equilibrium and once as frozen. The flow fields and diffusion processes formed in the centrifuge are discussed.

Author (NSA)

N72-16214# Oak Ridge Gaseous Diffusion Plant, Tenn.

DETERINATION OF THE TEMPERATURE AND FLOW RELATIONSHIPS IN THE INTERIOR OF A GAS CENTRIFUGE ROTOR

E. Jung [1971] 16 p Transl. into ENGLISH from Conf. Paper Stroemungsmechanishe Vorgaenge in Graszentrifugen, DFVLR-Kolloq., Porz-Whan, W. Ger., 14 May 1970 p 147-161 Sponsored by AEC

(K-Trans-61-5; Conf-700557-8) Avail: NTIS

The flow and temperature relationships in a very dilute gas in the interior of a rotating hollow cylinder (a gas centrifuge) were investigated in the absence of feed and withdrawal. The flow is driven solely by a prescribed radially symmetric temperature distribution on the wall of the cylinder. The system of equations under consideration - Navier-Stokes and the heat conduction equation - is solved numerically after transformation into a two-dimensional problem, omitting, of course, the equation of continuity. The numerical process itself is an iteration process combined with Fourier expansions. It is demonstrated here by two temperature cases. In addition, methods for automatic calculation are sketched.

Author (NSA)

N72-16215# Sandia Labs., Albuquerque, N.Mex.

AVERAGE SURFACE PRESSURE AROUND INCLINED BODIES OF REVOLUTION AT HYPERSONIC SPEED

M. D. Bennett and G. E. Barr Jun. 1971 16 p refs

(SC-RR-710287) Avail: NTIS

The average value of the local pressure at a number of points located on the surface and spaced in equal intervals around the circumference of an arbitrary body of revolution at angle of attack is determined for the hypersonic speed regime using Newtonian impact theory. It is found that when the number of points is three or more, the average normalized pressure depends only upon the local body slope and the total angle of attack, and is independent of both the aerodynamic roll angle and the number of points. Consequently, an axially symmetric pressure probe with as few as three orifices will have a manifold pressure that is independent of the roll attitude, provided the angle of attack does not exceed the local body slope, and the pressure will be equivalent to the average pressure acting around the complete circumference. On bodies of small slope, the sensitivity of the manifold pressure to the angle of attack is approximately one-half that of the windward and leeward meridians where sensitivity is maximum.

Author

N72-16216# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

PHOTOGRAPHIC STUDY OF TWO-PHASE HIGHLY DISPERSED FLOWS

M. Cumo, G. Ferrari, and G. E. Farello 24 Mar. 1971 22 p refs

(RT/ING/71/8) Avail: NTIS

A post-burnout two phase flow of a highly dispersed mixture of Freon-12 was analyzed by means of high speed cinematography. The Freon was electrically heated in a loop where, downstream from the heating section, a visualized test section was placed through which high-speed films were taken. The photographs were analyzed, taking into account the characteristics of the droplet population such as droplet dimensional distribution, velocity, trajectories, etc. Many diagrams of droplet dimensional distribution dependent on specific mass flow-rate, quality and heat flux were plotted, analyzing more than 10,000 droplets. With increasing flow rate and heat flux the dimensional distribution curves decrease towards minor diameters.

Author (NSA)

N72-16217# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Porz (West Germany).

KINETIC THEORY OF FLOW BETWEEN ROTATING CYLINDERS: THE GAS CENTRIFUGE

T. F. Morse 1970 23 p refs Presented at the Meeting on Mech. Flow Processes in Gas Centrifuge, Porz-Wahn, West Germany, 14 May 1970

(Conf-700557-5) Avail: AEC Depository Libraries

A moment method was used to obtain approximate solutions to the velocity distribution function for the problem of quasi-linear cylindrical Couette flow. This problem contains many of the essential flow features of the gaseous centrifuge, and although in this particular study, the effects of countercurrent flow were neglected, the strong assumption of the continuum equations was relaxed. The solution is uniformly valid for all ranges of the mean free path, as it must be in order to describe the flow both in the inner rarefied region and the outer continuum region. All of the macroscopic variables were reduced to a quadrature, and work is presently in progress to obtain these numerical results. The simple process factor for the separation of two isotopes has also been reduced to a quadrature for the case of no collisions, and it will be possible to compare this limiting case with experimental data on Couette flow.

Author (NSA)

N72-16218# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

TWO-PHASE PRESSURE LOSSES: FLOW REGIME EFFECTS AND ASSOCIATED PHENOMENA

D. R. H. Beattie May 1971 35 p refs
(AAEC/TM-589) Avail: AEC Depository Libraries

Pressure drops associated with the flow of a two-phase mixture comprise terms for the fluid head, acceleration, and two-phase friction, none of which can be said to be properly understood. However, the losses attributable to head and acceleration are usually a small part of the total, and satisfactory pressure loss calculations depend on the accuracy with which the frictional component is evaluated. The work reported here is an examination of the characteristics of two-phase friction data.
Author

N72-16219# Oak Ridge National Lab., Tenn.
ANALYSIS OF ROUND, TURBULENT, BUOYANT JETS DISCHARGED TO FLOWING STRATIFIED AMBIENTS
E. A. Hirst Jun. 1971 37 p refs
(Contract W-7405-eng-26)
(ORNL-4685) Avail: NTIS

Modern steam electric power plants discharge approximately 1.5 to 2 kWhr of waste heat for every kWhr of electrical energy produced. In order to assess the ecological consequences of waste heat discharge one must first know the physical changes (temperature, velocity, salinity) induced by these discharges. A new integral method is devised to predict the development of a momentum jet discharged to an infinite ambient through a single circular submerged diffuser. The jet is subjected to buoyancy forces, ambient cross flows, ambient turbulence, and ambient density stratification and will, in general, follow a three-dimensional path. This method differs from existing methods in several ways. First, the new method is applicable to a much wider range of flows. For example, the new method can handle flows for which the trajectories are three-dimensional, whereas existing methods are limited to jets with two-dimensional paths. Second, the method is based on an integration of the basic partial differential equations written in a new natural coordinate system. Deriving the integral equations from these basic equations reveals certain terms involving the turbulence and radius of curvature which do not appear in the older methods. Third, a new entrainment function has been postulated. This function includes the effects of internal turbulence, buoyancy, and cross flow. This new equation contains four coefficients, only one of which must be determined empirically by fitting the predictions to the data. The theoretical predictions have been compared with data for 100 different flows, and the agreement between theory and experiment is good.
Author

N72-16220# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
SUPERSONIC GAS-SOLID PARTICLE FLOW IN AN AXISYMMETRIC NOZZLE BY THE METHOD OF CHARACTERISTICS
G. R. Johnson Aug. 1971 51 p refs
(VKI-TN-78) Avail: NTIS

The governing equations are a set of eight first order, quasi-linear, partial differential equations. Seven of these equations are of the hyperbolic type when the flow is supersonic and can be solved by the method of characteristics. The eighth equation is rewritten as an integral equation to be solved. The resulting seven compatibility equations and the seven characteristics equations are solved by the modified Euler predictor-corrector algorithm. These equations were programmed for an IBM 1130 computer. A sample nozzle calculation is given and compared with the one-dimensional calculations.
Author (ESRO)

N72-16221# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
HOT WIRE MEASUREMENTS OF CONCENTRATIONS IN A GAS MIXTURE IN SUPERSONIC FLOW [MESURE AU FIL CHAUD DES CONCENTRATIONS DANS UN MELANGE GAZEUX EN ECOULEMENT SUPERSONIQUE]
Jean-Francois Devillers and GiaBan Diep Sep. 1971 40 p refs In FRENCH; ENGLISH summary
(Rept-71-3) Avail: NTIS

Helium and air mixtures are frequently considered in studies related to the effect of a secondary gas injected through the wall or in the wake of a body. In many cases it is useful to know the gas mixture composition. The large difference existing in the thermal conductivity of two gases makes possible the concentration measurement by means of the hot wire technique. It is shown how recording the energy communicated to the wire as well as the static and the impact pressures at the same flow location, it is possible to obtain concentrations either by iteration or using a graphic method.
Author (ESRO)

N72-16222# Centre National de la Recherche Scientifique, Meudon (France). Lab. d'Aerothermique.
EXPERIMENTAL STUDY OF JETS BEHIND CYLINDERS PLACED IN A FLOW AT MACH 17 [ETUDE EXPERIMENTALE DE JETS AU CULOT DE CYLINDRES PLACES DANS UN ECOULEMENT A MACH 17]
Christian Bisch and Jean Broggi Oct. 1971 44 p refs In FRENCH; ENGLISH summary
(Rept-71-4) Avail: NTIS

The hypersonic (Mach 17) near wake of an hemisphere cylinder including base injection is discussed. Impact pressure measurements allow deduction of analytical relations between characteristical points of the pressure curve along the centerline of the wake. In addition, mass spectrometer measurements are used in order to show an original form of the argon concentration in the hypersonic nitrogen near wake.
Author (ESRO)

N72-16223# Applicazioni e Ricerche Scientifiche, Milan (Italy).
MODELS FOR GAS SURFACE INTERACTIONS AND COMPUTATION OF AERODYNAMIC COEFFICIENTS Summary Scientific Report, 1 Aug. 1970 - 31 Jul. 1971
Carlo Cercignani 31 Jul. 1971 26 p refs
(Contract F61052-68-C-0020; AF Proj. 9783-02)
(AD-730607; AFOSR-71-2541TR) Avail: NTIS CSCL 20/4

The report is devoted to summarizing the research work carried out from August 1970 to July 1971. The research work on models for gas surface interaction is briefly recalled and the more recent work of computation of aerodynamic coefficient for some simple geometrical shapes is presented in some detail.
GRA

N72-16224# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
VISCOUS TRANSONIC FLOW IN RELAXING GASES
Martin Sichel and Y. K. Yin Sep. 1971 118 p refs
(Contract DAHC04-68-C-0008; DA Proj. 2O0-061102-B-33-G)
(AD-731834; UM-013610-2-T; AROD-7269-4-E) Avail: NTIS CSCL 20/4

A general differential equation governing the flow of a viscous, relaxing gas valid in the transonic range is derived. Using this equation, the structure of a shock wave with relaxation is studied in detail in order to clarify the effect of viscosity in relaxing flows. Asymptotic solutions, valid in three different regimes of flow, depending on the order of magnitude of the free stream frozen Mach number with respect to unity, have been obtained. The results show that the viscous solutions successfully eliminate some of the difficulties encountered in inviscid theory. It is also shown that the inviscid relaxing flow equation is valid as long as the free stream frozen Mach number is much less than one. A bulk viscosity can be used to account for the relaxation when the equilibrium Mach number is close to one. The analytic results have been verified by the numerical solution of the general equation. Two dimensional versions of viscous transonic relaxing equations valid for frozen and equilibrium regimes have also been obtained.
GRA

N72-16225# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
VISCOUS TRANSONIC FLOWS Final Report, 1 Oct. 1967 - 31 Mar. 1971
Martin Sichel Sep. 1971 16 p

(Contract DAHC04-68-C-0008; DA Proj. 200-61102-B-33-G)
(AD-731835; AROD-7269:5-E) Avail: NTIS CSCL 20/4

The report summarizes the results and conclusions reached in a study of viscous transonic flow which was made to determine the behavior of weak shock waves adjacent to curved surfaces, to study the effects of viscosity on the transonic flow of a vibrationally or chemically relaxing gas, and to investigate the transonic flow of an electrically conducting gas in a nozzle.
Author (GRA)

N72-16226# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DIRECT-INTERACTION APPROXIMATION BY THE MODAL INTERACTION PERTURBATION TECHNIQUE
Jon Lee Aug. 1971 32 p refs
(Task-7071-00-20)
(AD-732199; ARL-71-0133;) Avail: NTIS CSCL 20/4

An alternate method is presented of obtaining the direct-interaction equations by combining the heuristic and rigorous derivations of Kraichnan. Within the framework of the model dynamic representation of Kraichnan's rigorous theory, the author has developed the irreducible diagram expansion systematically by formalizing the perturbation argument of his heuristic derivation. It is hoped that the present work will provide a further insight into the analytical structure of the irreducible diagram expansion and bridge the gap apparent in the two original derivations of the direct-interaction equations given by Kraichnan.
Author (GRA)

N72-16227# Ohio State Univ. Research Foundation, Columbus.
BOUNDARY LAYERS ON AIRFOILS IN TRANSONIC FLOW AND THE CONTROL OF SHOCK-INDUCED SEPARATION
Final Report, 1 Jun. 1967 - 30 Dec. 1970
John D. Lee Aug. 1971 73 p refs
(Contract DAHC04-67-C-0051; OSURF Proj. 2426; DA Proj. 200-61102-B-33-G)
(AD-731830; AROD-7113-1-E) Avail: NTIS CSCL 20/4

The transonic terminal shock wave is always oblique (rather than normal) at the surface and the associated deflection of the boundary layer corresponds to the maximum deflection permitted by the Mach number upstream of the shock. When the Mach number is near 1 the deflection is small, and the separated boundary layer will usually reattach leaving a bubble separation. At higher Mach numbers the separation becomes more severe and reattachment may be affected only by extremes in boundary layer controls, e.g., streamwise blowing and vortex generators were found to be useful. In many cases, a controlled attachment simply results in a postponement of the separation to a higher Mach number with an increased deflection and higher drag. The study was performed with the OSU 12-inch transonic wind tunnel using 6-inch chord airfoil models in the Mach number range from 0.4 to 0.9. Data taken were in the form of surface static pressures, wake pitot pressures, force balance outputs and schlieren photographs.
GRA

N72-16228# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
REMARKS ABOUT VARIATIONAL PRINCIPLES FOR UNSTEADY AND STEADY THREE AND TWO DIMENSIONAL GAS FLOWS
K. G. Guderley and O. P. Bhutani (NRC) Aug. 1971 59 p refs
(AF Proj. 7071-00-10)
(AD-731801; ARL-71-0136;) Avail: NTIS CSCL 20/4

The report discusses in its first sections the role of Lagrange multipliers in the treatment of variational principles for unsteady three dimensional flows. This includes a formulation of the problem in function space and a discussion of the difference between the formulations of Herivel-Lin and Seliger-Whitham. A variational principle for three dimensional steady flows can be obtained from the formulation for unsteady flows by eliminating the time dependence. A procedure is required for the functional that is to be made stationary; it must be modified for steady flows by the inclusion of certain surface terms. A similar transition from steady three dimensional flows to conical flows applies only for linearized conical flows. By a procedure which is due to Vainberg it can be shown that for general conical flows a variational principle does not exist.
GRA

N72-16229# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
THE ANALYSIS OF NONEQUILIBRIUM, CHEMICALLY REACTING, SUPERSONIC FLOW IN THREE DIMENSIONALS. VOLUME 1: THEORETICAL DEVELOPMENT AND RESULTS Final Report, 1 Sep. 1968 - 31 Aug. 1971
Michael C. Cline and Joe D. Hoffman Wright-Patterson AFB, Ohio AFATL Aug. 1971 164 p refs
(Contract F33615-67-C-1068; Task-301209)
(AD-732217; AFAPL-TR-71-73-Vol-1) Avail: NTIS CSCL 20/4

A second-order numerical method of characteristics was used to solve the equations of motion for three-dimensional, steady, supersonic, nonequilibrium, chemically reacting flow of a system of thermally perfect gases in an exhaust nozzle. A production type computer program which is capable of solving a wide variety of supersonic nozzle problems was developed for the CDC 6500 computer. A bicharacteristic method of characteristics due to D.S. Butler and a special implicit method for the species continuity equations were employed. The chemical kinetic model considers 19 species formed from the 6 elements--carbon, hydrogen, oxygen, nitrogen, fluorine and chlorine--and 48 chemical reactions (13 dissociation-recombination reactions and 35 binary exchange reactions). In addition to the nonequilibrium chemistry model, the program also considers frozen and equilibrium flows, and flows with constant specific heat ratios. The absolute accuracy and order of accuracy of the method was shown by comparing the computed solution for spherical source flow with the exact solution for isentropic flow, and by comparing the computed solution for an axisymmetric, nonequilibrium flow with the results of an existing two-dimensional method.
Author (GRA)

N72-16230# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
COMPLICATED ONE DIMENSIONAL FLOWS
Gino Moretti Sep. 1971 55 p refs
(Contract DAHC04-69-C-0077; ARPA Order 1442)
(AD-731494; PIBAL-71-25; ARPA-Code-9E30) Avail: NTIS CSCL 20/4

A computational technique for one-dimensional, unsteady flow is presented. The technique emphasizes the role of discontinuities (shocks, contact discontinuities, gradient discontinuities) by treating them explicitly. Points inside regions of continuous flow are treated by a finite difference scheme of second order accuracy. Theoretical and practical arguments to support such an approach are given. The technique allows the computational time to be reduced to a minimum. The accuracy of the results as well as the generality of the program are shown by many applications to one-dimensional and quasi-one-dimensional problems.
GRA

N72-16231# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
NUMERICAL STUDIES OF UNSTEADY, TWO DIMENSIONAL LIQUID IMPACT PHENOMENA
Yen-Chen Huang Jun. 1971 148 p refs
(Contract NSF GK-730)
(PB-202216; Rept-03371-8-T) Avail: NTIS CSCL 11E

The dynamics of high speed impact between a compressible water droplet and a rigid solid surface is investigated analytically. Major efforts are made to examine the environment leading to the erosion mechanism of a material due to the liquid impingement. A compressible cell and marker numerical method is developed to solve the differential equations governing the unsteady, two-dimensional liquid-solid impact phenomena. The validity of the method is confirmed by comparing its numerical results with the exact solution for the classical one-dimensional liquid impact problem. The accuracy of the numerical results is found to be

superior to the other existing comparable numerical methods in this type of application. Author (GRA)

N72-16232# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THE HYPERSONIC LEADING EDGE PROBLEM. 2: WEDGES AND CONES
Michael L. Shorenstein Apr. 1971 47 p refs
(Contract N00014-67-A-0204-0040; ARPA Order 322)
(AD-731696; Pub-71-9) Avail: NTIS CSCL 20/4

An analysis is given for the viscous hypersonic flow past slender sharp wedges and unyawed cones. The leading edge or nose region treated encompasses the merged layer regime in which the shock thickness is not small in comparison with the viscous layer thickness but for which in the axisymmetric case the shock thickness is small in comparison with the radius of transverse shock curvature. A Navier-Stokes flow is assumed, and both the shock structure and viscous layer are taken to be locally-similar of boundary layer type. The analysis follows one that was used by Shorenstein and Probstein for the corresponding flat plat problem. For axisymmetric cone flow, a modification of a transformation introduced by Probstein and Elliott is given to reduce the axisymmetric viscous layer equations including transverse curvature to exactly two-dimensional form. Results for the state conditions behind the shock, and the wall pressure, skin friction, and heat transfer rate are found to be in agreement with available experimental data. GRA

N72-16233# Toledo Univ., Ohio.
INTERACTION BETWEEN EQUIPMENT STRUCTURES AND UNDERWATER SHOCK WAVES Final Report
Rudolph J. Scavuzzo (Rensselaer Polytech., Inst. of Conn., Hartford) Hartford, Conn. Rensselaer Polytech. Inst. of Conn. Jun. 1971 88 p refs
(Contract N00014-67-A-0555-0001)
(AD-731717; Rept-4) Avail: NTIS CSCL 13/10

The response of hull mounted submarine equipment structures can be idealized as an N-mass system and the hull as a rigid circular cylinder. Motion of the cylinder is determined by reflection of a one-dimensional pressure wave from the cylinder. Cavitation at the hull-water interface is included in the analytical model. Results of this study are compared to those obtained using a flat plate representation of the hull. Because of the hull curvature in this improved model, the rise time of the equipment is much less than in the previous model. As a result, agreement with trends observed in the experimental data are improved.
Author (GRA)

N72-16234# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
AN ANALYTICAL METHOD FOR CALCULATING TURBULENT SEPARATED FLOWS DUE TO ADVERSE PRESSURE GRADIENTS
Gary D. Kuhn (Nielsen Eng. and Res., Inc.) and Jack N. Nielsen (Nielsen Eng. and Res., Inc.) Oct. 1971 69 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038; Proj. SQUID)
(AD-731744; SQUID-TR-NEAR-1-PU) Avail: NTIS CSCL 20/4

A method has been developed for calculating incompressible turbulent boundary-layer characteristics smoothly across the separation point under the influence of an adverse pressure gradient. A special study of the separation point singularity is the basis of the method. Further work is needed to extend the method far enough downstream so that the complete separation region can be treated. The method contains a new formulation of the eddy viscosity to account for pressure gradients and includes the effects of surface curvature in the equations of motion. Excellent agreement is obtained between the theory and the separation measurements of Newman on an airfoil. Good agreement is obtained between theory and the measurements of Schubauer and Klebanoff except near separation. The normal pressure gradients existing in the experiments of Newman and of Schubauer and Klebanoff have been evaluated using the data. Preliminary indications are that normal gradients may not be important in calculating the boundary-layer characteristics. GRA

N72-16235# California Univ., La Jolla. Dept. of Aerospace and Mechanical Engineering Sciences.
JET TURBULENCE DISSIPATION RATE MEASUREMENTS AND COPPELATIONS
Carl A. Friehe, C. W. VanAtta, and Carl H. Gibson 29 Oct. 1971 11 p refs Repr. from the publ. "Turbulent Shear Flows" AGARD, 107 1 p 181-187
(Contract DA-31-124-ARO(D)-257)
(AD-732272; Conf-Preprint-93) Avail: NTIS CSCL 20/4

The rate of viscous dissipation in a turbulent jet is examined in some detail. A correlation of the mean rate of dissipation on the center-line in terms of the orifice Reynolds number and axial position is established. Measurements of the velocity and velocity derivative are described for a jet with an orifice Reynolds number of 120000. The spectrum of the square of the velocity derivative was examined for similarity to those obtained for atmospheric boundary layer flows at very large Reynolds numbers when normalized with Kolmogoroff length and time scales. Spectra of higher order moments of the velocity derivative are also presented and compared to Novikov's predictions of the power law subranges. Author (GRA)

N72-16779 California State Coll., Fullerton.
EFFECT OF HIGH POLYMER ADDITIVES ON DIFFUSER FLOW NOISE
B. M. Ishino and R. C. Binder (Univ. of Southern Calif., Los Angeles) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 151-157 refs (See N72-16765 07-32)
(Contract N60530-1136)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16797 IIT Research Inst., Chicago, Ill.
FULL-SCALE RECOIL MECHANISM SIMULATOR (FORCED FLUID FLOW THROUGH A CONCENTRIC ORIFICE)
W. J. Courtney, R. Rossmiller (Army Weapons Command), and R. Reade (Army Weapons Command) *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 187-194 (See N72-16781 07-32)
(Contract DAAF01-68-C-0174)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16827 LTV Research Center Anaheim, Calif. Western Div.
MEASURES OF BLAST WAVE DAMAGE POTENTIAL
C. T. Morrow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 17-26 refs (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16831 Kaman Sciences Corp., Colorado Springs, Colo.
SHOCK PULSE SHAPING USING DROP TEST TECHNIQUES
R. E. Keeffe and E. A. Bathke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 59-68 refs (See N72-16824 07-32)
(Contract DAAH01-69-C-1809)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2 Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16839 Boeing Co., Seattle, Wash.
FRAGILITY TESTING FOR HYDRAULIC SURGE EFFECTS
D. M. Eckblad and W. L. Hedrick (TRW Systems Group, Redondo Beach) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 143-153 (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390 $15.00/set

N72-16852 Florida Univ., Gainesville.
EXTENSION OF CLASSICAL BINARY FLUTTER MODEL USING ROOT LOCUS
J. C. Hornbuckle and R. L. Sierakowski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 109-121 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16856 Lockheed Missiles and Space Co., Sunnyvale, Calif.
A VARIATIONAL APPROACH TO THE FLUID-SHELL DYNAMIC INTERACTION PROBLEM
A. S. Benson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 151-168 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16860 California Inst. of Tech., Pasadena.
THE FLUTTER OF A HYDROFOIL
Thomas M. Ward and Raymond C. Binder (USC, Los Angeles, Calif.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 205-213 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16692*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLET-ENGINE-NOZZLE WIND TUNNEL TEST TECHNIQUES
D. N. Bowditch *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 16 p refs (See N72-16685 07-28)
(NASA-TM-X-67494) Avail: NTIS CSCL 20D

N72-16709*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A FLIGHT INVESTIGATION OF STEADY STATE AND DYNAMIC PRESSURE PHENOMENA IN THE AIR INLETS OF SUPERSONIC AIRCRAFT
Frank W. Burcham, Jr. and Donald R. Bellman *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs (See N72-16685 07-28)
(NASA-TM-X-67495) Avail: NTIS CSCL 20D

N72-16712# Politecnico di Milano (Italy). Ist. di Macchine.
ON THE APPLICATION OF A TIME DEPENDENT TECHNIQUE IN TRANSONIC DOUBLE FLOW NOZZLE SOLUTIONS
Carlo Osnaghi and Ennio Macchi *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16713# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VELOCITY DISTRIBUTION AT A SUPERSONIC COMPRESSOR INLET
Bernard Ledoux and Roger Bagot *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 10 p In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16714# A.S. Kongsberg Vapenfabrikk (Norway). Gas Turbine Div.
THE ANALYSIS OF A SUBSONIC AXISYMMETRIC INLET FOR COMPRESSOR MATCHING
R. E. Stanley *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 13 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16715# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STARTING CONDITIONS OF A MIXED COMPRESSION AXISYMMETRIC HYPERSONIC INLET
G. Laruelle and J. Leynaert *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 9 p refs In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16716# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDY OF THE COEXISTENCE OF TWO TYPES OF FLOW IN A CHANNEL WITH CONSTANT CROSS SECTION
Jacques Paulon *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16718# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
WIND TUNNEL INVESTIGATIONS OF A SUPERSONIC AIR INTAKE WITH VARIOUS AUXILIARY INTAKES AT LOW SPEEDS
Herbert Eibl and Reinhard Friedrichs (DFVLR, Brunswick) *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

N72-16046# Consiglio Nazionale delle Ricerche, Genoa (Italy). Lab. of Cybernetics and Geophysics.
PATTERN FORMATION IN DISSIPATIVE SYSTEMS
F. Gambale and A. Gliozzi *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 426-434 (See N72-16029 07-05)
Avail: NTIS HC $6.00/MF $0.95

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-16236# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INFORMATIONS RELATIVE TO CARTOGRAPHY AND GEODESY. SERIES 2: GERMAN CONTRIBUTIONS IN FOREIGN LANGUAGES, NO. 28
1971 59 p refs
Avail: NTIS

Gravimetric and astrogeodetic methods for geodetic surveys and celestial satellite geodesy are presented. For individual titles, see N72-16237 through N72-16244.

N72-16237# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AN INSTRUMENT FOR PRECISE MEASUREMENTS OF SMALL DIFFERENCES OF THE GRAVITY c14
Rudolf Brein *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 5-9 refs (See N72-16236 07-13)
Avail: NTIS

The construction of an instrument on the base of the vertical spring balance is reported. This mechanical most simple gravimeter system has some disadvantages. It is very insensitive with regard to gravity differences and sensitive with regard to seismic perturbations. Experiments carried out with a capacitance bridge show that a change of 1 micron gal can be indicated with that device. The elimination of seismic perturbations is carried out by air damping of the capacitor of the capacitance device and by electronic integration. The value of damping can be regulated in great limits by simple electronic elements. The gravity differences are measured by an electromagnetic spring. This mechanically simple device is used successfully since some years for registration of earth tides. Author

N72-16238# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE FORMING OF NORMAL EQUATIONS FOR THE ADJUSTMENT OF OBSERVATION EQUATIONS BY EDP METHODS c19
Dieter Ehlert *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 11-14 refs (See N72-16236 07-13)
Avail: NTIS

The optimal use of core memory space in adjusting the correlated observation equations of large networks of geodetic triangulations is considered. Application of Cholesky partitioning to the weight matrices results in combining the weights with the observation equations and eliminates storing weight matrices and more than one observation equation simultaneously with the matrix of normal equations. Quite a number of unknown quantities of the network, such as orientation corrections of angle sets, variable scale factors and the coordinates of auxiliary points can already be eliminated in the process of forming the normal equations. Finally a suggestion is made to store the elements of the lower triangular matrix of the normal equations in vector form and to invert this matrix on its own storage locations. Author

N72-16239# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ASTRONOMICAL OBSERVATIONS FOR THE GEOPHYSICAL INVESTIGATION OF THE NOERDLINGER RIES
H. Grosse, A. Roeedde, and G. Zimmermann *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 15-21 refs (See N72-16236 07-13)
Avail: NTIS

For the computation of astrogeodetic deflections, precise astronomical latitudes were observed at 12 stations along a meridian profile across the Ries, using the Horrebow-Talcott method. By adjusting all observations according to the method of least squares, the latitudes and also the value of the micrometer screw per one revolution and the angular displacement of the level axis per one division, were simultaneously determined. Author

N72-16240# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
POSSIBILITIES FOR THE GEOPHYSICAL RESEARCH OF THE NORDLINGER RIES BY THE USE OF ASTROGEODETIC DEFLECTIONS OF THE VERTICAL
Siegfried Heitz and Gerhard Soltam *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 23-27 refs (See N72-16236 07-13)
Avail: NTIS

Astrogeodetic deflections of the vertical by the mass deficiency under the Nordlinger Ries were determined. A procedure for the evaluation of these deflections is discussed and a comparison of the results with those of some models derived from gravity measurements is carried out. Author

N72-16241# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE RECEIVING OF VLF TIME SIGNALS c07
Klemens Nottarp *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 29-31 refs (See N72-16236 07-13)
Avail: NTIS

The accuracy of the time determination with VLF signals is limited by the transfer characteristics of the time receiver. To overcome this limitation during astronomical field work with the local quartz clock, a time signal is simulated similar to that of the VHF transmission. Both signals then are fed through the receiver and the time difference between them is measured on the receiver output. The receiver is used only as an indicator so that its transfer characteristics do not influence the time determination. This method together with a carrier-coherent signal produces an uncertainty of less than plus or minus 50 microseconds in a single time determination. Author

N72-16242# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE OPTIMUM NUMBER OF STAR IMAGES IN REDUCING OPTICAL SATELLITE OBSERVATIONS FROM CAMERAS OF SMALL FOCAL DISTANCE c14
Hermann Sessger *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 33-45 refs (See N72-16236 07-13)
Avail: NTIS

In order to determine the optimum number of reference star images for reducing optical satellite observations from Wild BC4 and IGN cameras, special test series have been carried out. A brief description of the method used in formulating the test criteria and a short summary of first results are given. Author

N72-16243# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
EXPERIMENTS WITH A DOUBLE CAMERA FOR SATELLITE OBSERVATIONS c14
Waldemar Wassermann *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 47-51 (See N72-16236 07-13)
Avail: NTIS

A double astrograph camera with two 1000/5.6 Zeiss-Jena mirror telescopes for the recording of active and passive satellites is described and first experiences from its practical use given. The methods of plate measurement and reduction are outlined. Author

N72-16244# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PROBLEMS OF THE ADJUSTMENT OF LARGE TRAVERSE NETS ON THE ELLIPSOID c19
Peter Wilson *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 53-64 refs (See N72-16236 07-13)
Avail: NTIS

A theory is developed for the adjustment of large traverse networks on the ellipsoid. The influence of the Laplace points is discussed. Author

N72-16245# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
INFORMATION RELATIVE TO CARTOGRAPHY AND GEODESY. SERIES 2: GERMAN CONTRIBUTIONS IN FOREIGN LANGUAGES, NO. 26
1970 24 p refs

Avail: NTIS

The technical facility and results for a satellite observation station in Norway are described, and a European base line computation for satellite triangulation nets is presented. For individual titles, see N72-16246 through N72-16247.

N72-16246# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

A PRELIMINARY COMPUTATION OF THE EUROPEAN BASE-LINE TROMSOE-HOHENPEISSENBERG FOR SPACE TRIANGULATIONS BY MEANS OF ARTIFICAL EARTH SATELLITES

Dieter Ehlert and Siegfried Heitz *In its* Inform. Relative to Cartography and Geodesy 1970 p 5-8 refs (See N72-16245 07-13)

Avail: NTIS

Computations on a European base line are performed for determining the scale of the satellite worldwide net and the subordinated space triangulations with artificial satellites between the stations Tromso and Catania. Computations are based as a rule on simple or double chains of triangles and on the Bomford geoid and its corrections. Adjustment of the net is carried out on the international ellipsoid by variations of coordinates using programs produced for the readjustment of the European triangulations. G.G.

N72-16247# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

REPORT ON SATELLITE OBSERVATIONS BY THE INSTITUT FUER ANGEWANDTE GEODAESIE AT THE SATELLITE TROMSO DURING WINTER 1968-1969

Waldermar Wassermann *In its* Inform. relative to Cartography and Geodesy 1970 p 9-17 refs (See N72-16245 07-13)

Avail: NTIS

Satellite observations at Tromso, Norway, were carried out in the framework of the West European satellite triangulation program in order to connect it with the worldwide American satellite triangulation scheme. During an observation period of about 4 months, the station received predictions and look-angle data for 566 events of the satellites PAGEOS and ECHO 2. Of these, only 312 predictions were effectively useable since the possibilities for satellite photography during winter were severely restricted by weather conditions. G.G.

N72-16248*# Physics International Co., San Leandro, Calif.

HYPERVELOCITY IMPACT CRATERING CALCULATIONS

D. E. Maxwell and H. Moises Jan. 1971 213 p refs

(Contract NAS9-9586)

(NASA-CR-115350; PIFR-190) Avail: NTIS CSCL 08M

A summary is presented of prediction calculations on the mechanisms involved in hypervelocity impact cratering and response of earth media. Considered are: (1) a one-gram lithium-magnesium alloys impacting basalt normally at 6.4 km/sec, and (2) a large terrestrial impact corresponding to that of Sierra Madera. Author

N72-16249*# Techtran Corp., Glen Burnie, Md.

SILICIC ACID CONTENT IN OCEANIC HYPERBASITES AND THEIR SERPENTINIZATION

L. V. Dmitriyev and A. V. Garanin Washington NASA Jan. 1972 13 p refs Transl. into ENGLISH from Geokhimiya (Moscow), no. 3, 1971 p 274-281

(Contract NASw-2037)

(NASA-TT-F-14105) Avail: NTIS CSCL 08C

For the evaluation of the degree of element removal and addition during serpentinization of hyperbasites, a correlation has been suggested between the Delta Si value, which shows the silicic acid consumption of the rock for serpentine formation and the amount of H2O(+). On the basis of 71 analyses of hyperbasites of the Indian Ocean and the Mid-Atlantic Ridges an equation has been obtained derived for the straight line which characterizes Delta Si with H2O(+) increasing. The comparison of this straight line with lines of possible theoretical Delta Si shows that the serpentinization of oceanic hyperbasites proceeded isochemically. Author

N72-16250# Institut d'Aeronomie Spatiale de Belgique, Brussels.

SIMPLE MODEL FOR AN ION-EXOSPHERE IN AN OPEN MAGNETIC FIELD

J. Lemaire and M. Scherer 1971 36 p refs

(Aeronomica-Acta-A-88) Avail: NTIS

A simple model for an ion-exosphere with an open magnetic field is presented. The ions move under the influence of the gravitational field, the monotonic decreasing static magnetic field, and the electrostatic potential due to a small charge separation. Neglecting collisions and particle drift across the magnetic field lines the particles are classified into four classes: ballistic, escaping, trapped, and incoming particles. For each class the number density, the particle flux, the momentum fluxes, and the energy flux are calculated as a function of the electrostatic potential. Finally, it is shown how this potential can easily be computed by considering the quasineutrality, and the zero current condition. Author

N72-16251*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

INTERPLANETARY MAGNETIC SECTOR POLARITY INFERRED FROM POLAR GEOMAGNETIC FIELD OBSERVATIONS

Eigil Eriss-Christensen (Danish Meteorol. Inst., Charlottenlund), Kund Lassen (Danish Meteorological Inst., Charlottenlund), John M. Wilcox (Calif. Univ., Berkeley), Gonzalez (Calif. Univ., Berkeley), and David S. Colburn Charlottenlund, Denmark Danish Meteorol. Inst. 1971 7 p refs Supported in part by ONR and NSF

(NASA-TM-X-67518; R-26; ISBN-87-7478-046-8) Avail: NTIS CSCL 08N

With the use of a prediction technique it is shown that the polarity (toward or away from the sun) of the interplanetary magnetic field can be reliably inferred from observations of the polar geomagnetic field. Author

N72-16252*# Translation Consultants, Ltd., Arlington, Va.

OBSERVATIONS OF IONIZED CALCIUM EMISSION AT TWILIGHT

Huu-Doan Nguyen Washington NASA Feb. 1972 18 p refs Transl. into ENGLISH from Ann. Geophys. (Paris), v. 22, no. 4, Oct. - Dec. 1966 p 599-608

(Contract NASw-2038)

(NASA-TT-F-14135) Avail: NTIS CSCL 04A

The results of the year 1965 show that the emission is frequent during summer (June, July, August) and particularly during July. It was not seen in the rest of the year except about January 5, 1966. In most cases the layer of ionized calcium seems to be widely spread in altitude (from 100 to 200 km) and the variation of the number of ions Ca(+) in relation to the height is slow. There is no correlation between the intensity of H and K lines and the planetary geomagnetic index Kp. The distribution of ions Ca(+) and N2(+) in altitude is not the same. The ionized calcium which was observed might be of meteoric origin because the apparition of H and K lines, intense in the high atmosphere during summer, is to be compared with important daily meteoric showers which were detected with radar for about twenty years. Author

N72-16253# Joint Publications Research Service, Washington, D.C.

SCREENING EFFECT OF THE CONTINENTS DETERMINING ISOTOPIC COMPOSITION OF ATMOSPHERIC MOISTURE

V. N. Soyfer, V. V. Romanov, N. K. Gasilina, and Ye. I. Roslyy 26 Jan. 1972 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Geofiz. (Moscow), v. 201, no. 1, 1971 p 78-81

(JPRS-55027; UDC-550.42; CSO-01480/72-W) Avail: NTIS

Systematic tritium observations in atmospheric precipitation are quantitatively analyzed to establish the continental screening effect on the composition of atmospheric moisture. It is shown that this effect leads to the enrichment of the atmospheric moisture by tritium of stratospheric origin as it moves into the depths of the continents, whereas the transfer of atmospheric moisture over the ocean leads to washing out of tritium through the processes of evaporation and molecular exchange at the water surface. G.G.

N72-16254# National Bureau of Standards, Washington, D.C. Inst. for Materials Research.
MEASURES FOR AIR QUALITY Annual Report, Fiscal Year 1971
J. R. McNesby and R. Byerly, Jr. Jan. 1972 78 p refs
(NBS-TN-711) Avail: SOD $0.70 as SD-C13.46:71

Brief reports on air pollution related projects are presented. The most significant advances are identified as (1) construction of an apparatus for measuring particle size distribution in less than one minute, (2) experimental measurements for the design of an interference-free, real-time apparatus for measuring sulfur dioxide in the ppm region, and (3) development of standard reference materials for monitoring ambient sulfur dioxide and carbon monoxide. Other research included the chemistry and identification of pollutants and carcinogens, indoor air pollution, measuring and detecting instruments, smog, and rubber emissions. N.E.N.

N72-16255*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD ANOMALIES IN THE LUNAR WAKE
Y. C. Whang (Catholic Univ. of Am.) and Norman F. Ness Oct. 1971 24 p refs Submitted for publication
(Grant NGR-09-005-063)
(NASA-TM-X-65807; X-690-71-491) Avail: NTIS CSCL 03B

The interplanetary magnetic field is only slightly perturbed by the presence of the moon in the solar wind flow. A statistical study of umbral increases and of penumbral variations was conducted with respect to variation in the solar wind plasma value beta, the distance from the moon, and the selenographic longitude of the limb regions of the lunar surface in the solar wind flow. All lunar wake anomalies show a strong positive correlation with the plasma value beta, while only penumbral increases show a marked variation with distance from the moon. There is no clear correlation of penumbral anomaly occurrence with selenographic longitude of the exposed lunar limb in the solar wind flow. Author

N72-16256*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH PHYSICS AND PHASE TRANSFORMATIONS PROGRAM: A CONCEPT AND PROPOSAL
N. L. Bonavito and T. Tanaka (Catholic Univ. of Am.) Nov. 1971 84 p refs
(NASA-TM-X-65806; X-552-71-487) Avail: NTIS CSCL 08E

A program to study the geophysical characteristics of the earth is presented as an integration of the different disciplines that constitute the earth sciences, through the foundation of a generalized geodynamic theory of earth physics. A program is considered for defining the physical constants of the earth's material which parametrize the hydrodynamic equation in the microscopic solid state behavior of the crystals of the lithosphere. In addition, in order to lay the foundation for a generalized theory in earth physics, specific research areas are considered, such as the nature of the kinetics of the phase transitions in mineral assemblages, the equilibrium thermodynamic properties of crystals which are major constituents of mineral assemblages, and the transport properties of pure crystals which are major constituents of mineral assemblages. Author

N72-16257*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERTICAL RESOLUTION OF TEMPERATURE PROFILES OBTAINED FROM REMOTE RADIATION MEASUREMENTS
Barney J. Conrath Nov. 1971 31 p refs Submitted for publication
(NASA-TM-X-65808; X-622-71-519) Avail: NTIS CSCL 08E

The Backus-Gilbert theory is applied to the problem of the vertical sounding of the atmosphere by means of remote radiation measurements. An application is made to spectral intervals 2.8/cm wide in the 667/cm band of CO2, and tradeoff curves are presented which quantitatively define the relationship between intrinsic vertical resolution and random error in temperature profile estimates. It is found that for a 1-2K random error with state-of-the-art instrumentation, the intrinsic vertical resolution ranges from approximately 0.5 local scale height (l.s.h.) in the lower troposphere to > 2 l.s.h. in the upper stratosphere with approximately 2 l.s.h. resolution in the vicinity of the tropopause. These values are somewhat smaller than the widths of the radiactive transfer kernels at similar levels. Increasing the number of spectral intervals from 7 to 16 is found to produce only a marginal improvement in vertical resolution. Author

N72-16258# Weapons Research Establishment, Salisbury (Australia).
IONOSPHERIC DATA FOR SEPTEMBER 1970 FROM SALISBURY, SOUTH AUSTRALIA
Jul. 1971 29 p ref
(SAD-1970/9(S)) Avail: NTIS

Tables of the hourly values of the customary ionospheric parameters are given for the station at Salisbury for September 1970. Author

N72-16259# Forsvarets Forskningsanstalt, Stockholm (Sweden).
RADIOACTIVE TUNGSTEN IN THE ATMOSPHERE FOLLOWING PROJECT SCHOONER
Gunnar Persson Apr. 1971 7 p refs
(FOA-4-4460; C-4460-28) Avail: AEC Depository Libraries

The W-181 concentrations observed in ground-level air in Sweden are given and compared to observations at other locations. The integrated W-181-concentration in Swedish ground-level air was of the order 10 fCi-days/kg. Author (NSA)

N72-16260# Argonne National Lab., Ill.
RADIOLOGICAL PHYSICS DIVISION ENVIRONMENTAL STUDIES Annual Report, Jul. 1969 - Dec. 1970
Dec. 1970 269 p refs
(Contract W-31-109-eng-38)
(ANL-7760-Pt-3) Avail: NTIS

The environmental studies include atmospheric sciences, terrestrial ecology, radiological physics of the Great Lakes region, and bioenvironmental studies. The atmospheric research emphasized urban meteorology, atmospheric chemistry, and lake meteorology. The ecological research focussed on water balance and nutrient flow through local ecosystems; particular attention was devoted to tritium behavior between various trophic levels. Measurements of existing thermal discharges into Lake Michigan, and the distribution of radionuclides from the Big Rock Nuclear Plant in water, sediments, and biota are reported. The Grant River outflow is being used as an analog of a power plant discharge. Monitoring of fallout in air, soil, food, and man is being continued. Author

N72-16261# Interuniversitair Reactor Instituut, Delft (Netherlands).
NEUTRON ACTIVATION ANALYSIS USES IN ENVIRONMENTAL POLLUTION PROBLEMS
J. J. M. DeGoeij, J. P. W. Houtman, and H. A. Das (Reactor Centrum Nederland, Petten) May 1971 20 p refs Presented at the 4th Intern. Conf. on the Peaceful Used of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/p-19; A/Conf-49/P/19; Conf-71091-69) Avail: AEC Depository Libraries

An extensive study of sludge transport was made in which

neutron activation was used for analysis for polluting elements. Activation analyses for manganese, chromium, copper, lanthanum, cobalt, samarium, and scandium were performed nondestructively. The mercury determination in water, sludge, and a variety of biological samples was carried out destructively. Neutron activation was also used in air pollution studies for the routine analysis of air dust samples. Instrumental determinations were performed after activation with thermal and fast neutrons, and with photons. Twenty elements were determined initially; As, Mo, Cd, I, and Hg were determined after chemical separation following irradiation with thermal neutrons. Fluorine was determined by fast neutron activation, followed by chemical isolation of H2SiF6.
NSA

N72-16262# Environmental Research Corp., Las Vegas, Nev.
CALCULATED COMPRESSIONAL WAVE ARRIVALS FROM UNDERGROUND NUCLEAR DETONATIONS
J. R. Murphy May 1971 66 p refs
(NVO-1163-225) Avail: NTIS

Using a seismic source function and crustal model appropriate for the nuclear event Boxcar, the particle velocity profiles corresponding to those compressional wave types which are routinely identified on measured seismograms were calculated and compared with the observed data for this event. These comparisons indicate that the peak amplitudes of some important compressional wave types can be predicted with reasonable accuracy using a relatively simple model of the seismic transmission path. These initial results indicate the feasibility of calculating relative transmission path factors for Nevada Test Site (NTS) and off-NTS underground nuclear tests.
Author (NSA)

N72-16263# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.
ENTRY OF HIGH ENERGY SOLAR PROTONS INTO THE DISTANT GEOMAGNETIC TAIL
A. C. Durney, G. E. Morfill (Imp. Coll. of Sci. and Technol.), and J. J. Quenby (Imp. Coll. of Sci. and Technol.) Mar. 1971 38 p refs Sponsored in part by Brit. Sci. Res. Council
Avail: NTIS

During the solar proton events of 18 November 1968 and 25 February 1969, the structure in proton intensities in the rigidity range between 0.4 and 0.9 Gv was observed over the polar caps from the ESRO-2 satellite. By using trajectory calculation and assuming the divergence of the geomagnetic tail field to be small, part of the structure for both events was found to be caused by protons entering the cislunar region from distant parts of the tail, eventually arriving at low altitudes over the pole. A possible explanation is given for the transfer of the anisotropy in the outward streaming in the planetary solar proton flux to tail trajectories moving towards earth with small pitch angles.
ESRO

N72-16264# Royal Aircraft Establishment, Farnborough (England).
AIR DENSITY AT HEIGHTS NEAR 150 km IN 1970, FROM THE ORBIT OF COSMOS 316 (1969-108A)
D. G. King-Hele and Doreen M. C. Walker Jun. 1971 29 p refs
(RAE-TR-71129) Avail: NTIS

Cosmos 316 (1969-108A) was launched on 23 December 1969 into an orbit with an initial perigee height of 154 km at an inclination of 49.5 deg to the equator. Being very massive, Cosmos 316 had a longer lifetime than any previous satellite with such a low initial perigee: it remained in orbit until 28 August 1970. Because of its interest for upper-atmosphere research, the satellite was intensively observed, and accurate orbits are being computed at RAE from all available observations. Using perigee heights from the RAE orbits so far computed, and decay rates from Spacetrack bulletins, 102 values of air density have been obtained, giving a detailed picture of the variations in density at heights near 150 km between 24 December 1969 and 28 August 1970. The three strongest geomagnetic storms, on 8 March, 21 April and 17 August 1970, are marked by sudden increases in density of at least 23%, 15% and 24% respectively. With values of density extending over eight months, it is possible for the first time to examine a complete cycle of the semi-annual variation at a height near 150 km: the values of density, when corrected to a fixed height, exhibit minima in mid-January and early August; at the intervening maximum, in April, the density is 30% higher than at the minima.
Author (ESRO)

N72-16265# Institut Royal Meteorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly bulletin, Jun. 1971 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE BULLETIN MENSUEL, JUIN 1971]
1971 31 p In FRENCH and DUTCH
Avail: NTIS

Results of ionospheric and cosmic ray (neutron component) observations at Dourbes (Belgium) are tabulated for June 1971.
ESRO

N72-16266# Pittsburgh Univ., Pa. Dept. of Physics.
EXPERIMENTAL RESEARCH ON COLLISIONS INVOLVING EXCITED MOLECULES AND COLLISIONS INVOLVING METALS Final Report, 15 Dec. 1964 - 31 Jan. 1971
Wade L. Fite 4 Oct. 1971 14 p refs
(Grants DA-ARO-(D)-31-124-70-G48; DA-ARO(D)-31-124-70-G627; DA-ARO(D)-31-124-70-G780; DA-ARO(D)-31-124-70-G883; DA-ARO(D)-31-124-70-G982; DA-ARO(D)-31-124-70-G1085; AROD Proj. 5514-P)
(AD-731839; AROD-5514-5-P; PITT-6100) Avail: NTIS CSCL 07/4

Research described in the report pertains to the effects of nuclear detonations in the upper atmosphere. Experiments described include dissociative attachment to hot oxygen, reactions between atmospheric ions and sodium atoms, collisions of sodium ions with ozone, internal energy effects in ion-molecule reactions, reactions between atmospheric ions and metal atoms using magnetically confined afterglows, electron impact dissociation of oxygen and carbon dioxide, effect of internal excitation on dissociative ionization, and dissociative attachment to water-clustered molecules.
Author (GRA)

N72-16267# Naval Research Lab., Washington, D.C. Radar Geophysics Branch.
MIDDAY ELECTRON DENSITY PROFILES OVER RANDLE CLIFF FOR MARCH 1971 Interim Report
John M. Goodman and Melvin W. Lehman Sep. 1971 73 p refs
(RR Proj. 008-01-41)
(AD-732000; NRL-MR-2344; NRL-53R07-28) Avail: NTIS CSCL 04/1

Electron density distributions of the ionosphere over the NRL Randle Cliff Radar are presented for the month of March 1971. A Thomson scatter technique using Faraday rotation was employed. Parameters such as the peak density N sub(F2 max) the height to the peak h sub(F2 max) the total electron content C, the slab thickness Tau, and the scale height H are determined. The degree of correlation between these parameters is deduced and the effect of magnetic activity on the ionospheric profile is briefly explored.
Author (GRA)

N72-16268# Army Foreign Science and Technology Center, Charlottesville, Va.
FUNDAMENTAL TASKS OF THE CARTOGRAPHIC SERVICE OF GUGK IN 1970
A. N. Baranov 22 Sep. 1971 9 p Transl. into ENGLISH from the publ. "Osnovye Zadachi Kartograficheskoi Sluzhby GUCK" 1970 G p 7-9
(AD-732255; FSTC-HT-23-336-71; ACSI-J-9514; T7-; UDC-528.9 02301-2301) Avail: NTIS CSCL 08/7

The report describes the present status of Soviet cartography.

and the current objectives of the Main Administration of Geodesy and Cartography (GUGK). Author (GRA)

N72-16269# Army Foreign Science and Technology Center, Charlottesville, Va.
ALPHABETICAL INDEX OF ARTICLES PUBLISHED DURING 1970 IN THE JOURNAL, GEODEZIYA I KARTOGRAFIYA
14 Jul. 1971 19 p Transl. into ENGLISH from Geodez. i. Kartograf. (Moscow), no. 12, 1970 p 74-80
(AD-732251; FSTC-HT-23-1123-71) Avail: NTIS CSCL 08/2

An alphabetical index of articles published during 1970 in the journal, 'Geodeziya i Kartografiya' is presented.
Author (GRA)

N72-16270# Avco-Everett Research Lab., Everett, Mass.
SECEDE LASER RADAR EXPERIMENT Final Technical Report
I. Itzkan, P. G. DeBaryshe, and R. A. Kirk Aug. 1971 49 p refs
(Contract F30602-71-C-0025; ARPA Order 1057; Proj. Secede)
(AD-731860; RADC-TR-71-230) Avail: NTIS CSCL 04/1

In support of the SECEDE 2 barium release test series, AVCO-Everett Research lab. conducted an experiment to demonstrate the feasibility of making measurements of spatial density distribution in a barium ion cloud. The feasibility measurements were made with a laser radar breadboard which transmits laser pulses at the wavelengths of the 4934A ion ground state resonance line, and detects the return signals by means of a collecting telescope and photomultiplier, all mounted on an alt-azimuth platform. A videotape recorder was used to record the time resolved return signals, and a boresight camera was used to record pointing information. Provisions were included for control, display and field calibration of the system. Preliminary reductions and evaluation of a small fraction of the tape recorder data has been accomplished. Author (GRA)

N72-16271# Aeronautical Chart and Information Center, St. Louis, Mo.
USER'S GUIDE TO UNDERSTANDING CHART AND GEODETIC ACCURACIES
Clyde R. Greenwalt Sep. 1971 39 p refs
(AD-732213; ACIC-Ref-Pub-28) Avail: NTIS CSCL 08/2

Positional information in the form of charts, target positioning data bases, and descriptions of specific installations is produced to support the navigational and target position requirements of various tactical and strategic weapon systems. An explanation of the terminology used to define the horizontal and vertical accuracy of these products is included in this report. Horizontal and vertical accuracy are described in terms of circular and linear error, respectively. The accuracy statement on a product defines relative accuracy when describing the relationship of features within the borders of a chart of within a specified area, and defines absolute accuracy when the features are evaluated with respect to a geodetic datum (geographic positions) or mean sea level (elevations). Illustrations are included to clarify these terms. Author (GRA)

N72-16272# Army Foreign Science and Technology Center, Charlottesville, Va.
SOME METHODS AND PLANS FOR A CLASS 2 POLYGONOMETRIC NETWORK AND SURVEYING BASIS
A. Sh. Tatevyan 28 Sep. 1971 16 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 8, 1970 p 6-13
(AD-731278; FSTC-HT-23-829-71) Avail: NTIS CSCL 08/5

Polygonometric (theodolitic) and azimuthal (gyrotheodolitic) methods of constructing class 2 geodesic networks are briefly explained and shown to be simpler, less laborious and cheaper than triangulation. Author (GRA)

N72-16273# Battelle Memorial Inst., Columbus, Ohio.
SIMULATION OF NATURAL AND ENHANCED RADIO AURORAS Final Report, 31 Jul. 1970 - 30 Sep. 1971
James T. Coleman Sep. 1971 94 p refs
(Contract DASA01-69-C-0144; NWER Proj. XAXH)
(AD-731400; DNA-2752F) Avail: NTIS CSCL 04/1

The long-term objective of this program is to develop, from laboratory simulations of the D- and E-regions of the atmosphere, a model to represent the cross section and attenuation effects induced by natural and nuclear-induced auroral formations. The program performed in FY 70 demonstrated the capability developed at Battelle's Columbus Laboratories for the scaled simulation of the natural aurora. The present program has as its objective the extension of the capabilities of the FY 70 system to include very intense, overdense auroras, auroras that would decay with time to better represent the radar effects produced by the equivalent of a nuclear-induced aurora. Wide-range enthalpy sweeps permitted the generation of a decaying magnetoactive scaled D-region simulation whose electron density varied from 10 to the 11th power to 10 to the 9th power electrons/cc. A large portion of the program in FY 71 was devoted to the development of equipment that would survive in the 5000K environment. After considerable effort all systems were extended in capability to permit steady-state operation at the above temperature. Initial forward scatter and back-scatter data were accumulated. A static auroral simulation facility was used to make fine-grain measurements of the buildup of auroral back-scatter for various altitude regimes. For the simulated upper D-region strong backscatter effects due to an auroral electrojet were measured. The cross sections were considerably enhanced as the electrojet level was increased and evidence of nonlinear coupling between modes observed. A theory for the prediction of the cross-section buildup due to an auroral electrojet system is given. GRA

N72-16274# Naval Underwater Systems Center, Newport, R.I.
VOLUME REVERBERATION STUDIES WITH DEEP RESEARCH VEHICLE DEEPSTAR 4000
Robert K. Duller and Norbert P. Fisch 30 Apr. 1971 25 p refs
(USL Proj. A-403-00-00; Task-SF11-552-002-11-284)
(AD-731361; NUSC-4073) Avail: NTIS CSCL 08/10

From July to October 1967, reverberation caused by the Deep Scattering Layers (DSL) was measured from the DRV Deepstar 4000 in the Gulf of Mexico and on the continental rise from Florida to Nova Scotia. A narrow-beam, transducer-reflector system operating between 3.25 and 4.75 kHz was employed at several depths to make horizontal transmissions with pulse lengths of 40 and 120 msec, while graphic records of the depth of the DSL were obtained concurrently onboard the support ship. Daytime scattering strengths were at a noise threshold of -80 db, except at one northern station where -70 db was found. Maximum nighttime values of scattering strength of -55 db were observed east of Delaware with decreases in magnitude both north and south of this location. East of Cape May, results obtained 1 year earlier with DRV Star 3 were confirmed. Nighttime reverberation was attributed to scatterers between the surface and a depth of 300 m. Also, no measurable frequency dependence in scattering strength was noted in the range from 3.25 to 4.75 kHz. Author (GRA)

N72-16275# Naval Underwater Systems Center, Newport, R.I.
SOUND ATTENUATION IN THE RED SEA
Everett N. Jones, David G. Browning, William H. Thorp, and Robert H. Mellen 2 Aug. 1971 47 p refs
(USL Proj. A-401-00-00; Task-SF11-552-008-11-282)
(AD-731362; NUSC-4101) Avail: NTIS CSCL 08/10

Many experiments have shown that the attenuation of low-frequency (below 10 kHz) sound in sea water is at least 10 times the value predicted by extrapolation from higher frequencies. Since attenuation is a factor in sonar design and propagation prediction, the Naval Underwater Systems Center has initiated a program to determine the exact magnitude, variation, and cause of this anomaly throughout the oceans of the world. This report describes the first experiment, which was conducted in the Red

Sea. The results show a shift in relaxation frequency from 1 kHz (Atlantic) to 1.5 kHz (Red Sea). The corresponding activation energy is 3.1 kcal/mole. Results support the contention that a chemical relaxation causes the anomaly. In practical terms, this experiment shows that the Thorp formula gives a good estimation for attenuation anywhere in the oceans and can be made more exact by correcting for temperature. Author (GRA)

N72-16276# Royal Swedish Academy of Engineering Sciences, Stockholm.
THE MAGNETIC FIELD OF THREE DIMENSIONAL MAGNETOSPHERIC MODEL CURRENT SYSTEMS AND CURRENTS INDUCED IN THE GROUND
Rolf Bostrom 1971 32 p refs *Its* Acta Polytech. Scand. Phys. Nucl. Ser.
(PB-202108; APS-PH-77; UDC-550.38) Avail: NTIS CSCL 04A

High latitude magnetic disturbances are caused by currents flowing in the auroral ionosphere and along the geomagnetic field lines connecting the ionospheric part of the current system with currents in the outer magnetosphere. An account is given of methods to study the magnetic disturbances of model current systems including field-aligned currents. Direct integration, spherical harmonic expansion, and effects of currents induced in the ground are discussed and some examples given.
Author (GRA)

N72-16277# Wisconsin Univ., Middleton.
NOTES ON ACOUSTICS
C. S. Clay Aug. 1971 129 p refs Sponsored in part by ONR
(AD-731711; RR-71-2; Contrib-272) Avail: NTIS CSCL 20/1

Contents: Ray tracing through multiple layers; Focusing at the crossing of ray paths; Scattering and reflection of sound at the bottom; Rough sea floor, its statistical description; Integration of the scattering function; Backscattering of sound. GRA

N72-16278# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
THE DYNAMIC STRUCTURE OF A WIND-INDUCED EDDY M.S. Thesis
Thomas Stephen OKeefe, Jr. Aug. 1971 51 p refs
(Contract N00014-67-A-0201-0013; NR Proj. 083-060/7-16-70(481))
(AD-731706) Avail: NTIS CSCL 08/3

The response of the ocean to an axisymmetric cyclone is investigated using a model based on the conservation of potential vorticity in the interior. The results, which confirm the conservation potential vorticity, are used to obtain limiting values of the vertical eddy diffusivity and an effective Ekman depth. Some aspects of the response as a function of the horizontal wavenumber are also investigated. It is found that high wavenumber motion does not penetrate as deeply as low wavenumber motion. Author (GRA)

N72-16279# California Univ., Riverside. Dept. of Geography.
A DEMONSTRATION OF THE USE OF THE GRID SYSTEM UTILIZING MULTISOURCE INPUTS
David A. Nichols, Jack P. Dangermond (Environ. Systems Res. Inst., Redlands, Calif.), and Raymond Postma (Environ. Systems Res. Inst., Redlands, Calif.) Aug. 1971 41 p refs
(Contract N00014-69-A-0200-5001; Task-N-387-047; Proj. Themis)
(AD-731703; TR-T-71-4) Avail: NTIS CSCL 08/2

The paper demonstrates the use of a grid cell digital system to integrate data derived from high altitude aerial photographs with other sources of information (e.g. topography, road maps, geology, etc.). The system has the capabilities of data storage, retrieval, and manipulation. A data bank file possessing spatial characteristics can be displayed with computer graphics, and manipulated in the computer. The demonstration involves the application for a regional park location model. Author (GRA)

N72-16280# Radiation Research Associates, Inc., Fort Worth, Tex.
MONTE CARLO CALCULATIONS OF THE SCATTERING OF 450, AND 650 mm WAVELENGTH LIGHT IN MODEL ATMOSPHERES FOR POINT ISOTROPIC SOURCES Final Report, 1 Oct. 1970 - 30 Sep. 1971
Michael B. Wells, Wolfram G. Blaettner, and Dave G. Collins 15 Aug. 1971 152 p refs
(Contract N60921-71-C-0053)
(AD-731723; RRA-T7108) Avail: NTIS CSCL 04/1

The FLARE Monte Carlo procedure, which computes the transport of monochromatic light emitted by either point or plane-parallel sources in a plane atmosphere, was made operational. The FLARE procedure treats problems involving light transport in atmospheres where the scattering and absorption processes vary with altitude. The FLARE procedure was used to compute the scattered and direct intensities as a function of direction and horizontal range at receiver altitudes of 0, 1, 2, 5, and 10 km. Problems were run for 550 nm wavelength point isotropic sources at 1, 2, 5, 20 and 80 km altitude in a model atmosphere with a ground level meteorological range of 10 km. Calculations were made for the 550 nm wavelength point isotropic source at 2 km altitude in model atmospheres with ground level meteorological ranges of 3, 10, 25, and 50 km. Additional calculations were also performed for 450, 550, and 650 mm wavelength point isotropic sources at 2 km altitude in the model atmosphere with a 10 km ground level meteorological range. Author (GRA)

N72-16281# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ION COMPOSITION AND VERTICAL DISTRIBUTION OF CHARGED PARTICLES IN THE F REGION OF THE IONOSPHERE AND IN THE PROTONOSPHERE
M. A. Kutimskaya and V. M. Polyakov 18 Aug. 1971 29 p refs Transl. into ENGLISH from the Publ. "Sibirskiy Institut Zemnogo Magnetizma Issledovsniye Ionosfrey" Novosibirsk, Nauka, 1970 p 64-89
(Contract F33657-71-D-0057; AF Proj. M122)
(AD-731905; FTD-HC-23-370-71) Avail: NTIS CSCL 04/1

Data concerning the ion composition and vertical distribution of charged particles in the F region of the ionosphere and in the protonosphere are presented. The data were obtained by ground-level and extra-terrestrial methods of observation. The latitudinal, time, and altitudinal variations of the electron concentration in the upper ionosphere and the altitudinal variations of the ion composition during a cycle of solar activity are investigated. Author (GRA)

N72-16086# Army Engineer Topographic Labs., Fort Belvoir, Va.
A PROGRAM FOR THE DEVELOPMENT OF ADVANCED CAPABILITIES FOR COLLECTION, ANALYSIS, PRODUCTION AND DISSEMINATION OF MILITARY GEOGRAPHIC INTELLIGENCE
Kenneth R. Kothe *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 36 p (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16087# Army Engineer Topographic Labs., Fort Belvoir, Va.
PROJECT SAND: REMOTE SENSING FOR ENGINEER CONSTRUCTION MATERIALS
Donald G. Orr and James R. Quick *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 17 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16088# Development and Resources Transportation Co., Silver Spring, Md.
AUTOMATIC PROCESSING OF ARCTIC PACK ICE DATA OBTAINED BY MEANS OF SUBMARINE SONAR AND

OTHER REMOTE SENSING TECHNIQUES
Leonard A. LeSchack, William D. Hibler, III (Army Cold Reg. Res. and Eng. Lab., Hanover, N. H.), and Frederick H. Morse (Maryland Univ., College Park) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs Original Contains Color Illustrations (See N72-16085 07-07)
(Contract N00014-70-C-0110; NR Proj. 307-322)
Avail: NTIS HC $6.00/MF $0.95

N72-16092*# Kansas Univ., Lawrence. Dept. of Geography.
VEGETATION MAPPING WITH SIDE LOOKING AIRBORNE RADAR: YELLOWSTONE NATIONAL PARK
Norman E. Hardy, Jerry C. Coiner, and William O. Lockman *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs (See N72-16085 07-07)
(Contract NAS9-10261)
(NASA-CR-125451) Avail: NTIS HC $6.00/MF $0.95 CSCL 08B

N72-16095# Naval Research Lab., Washington, D.C.
REMOTE PASSIVE MICROWAVE MEASUREMENTS OF THE SEA SURFACE
James P. Hollinger *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16096# Naval Research Lab., Washington, D.C.
REMOTE SENSING OF OCEAN EFFECTS WITH RADAR
N. W. Guinard *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 12 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16099# Wisconsin Univ., Middleton. Geophysical and Polar Research Center.
ELECTROMAGNETIC SOUNDING OF ICE THICKNESS
C. R. Bentley and J. W. Clough *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 7 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16101# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
REMOTE SENSING OF TROPOSPHERIC STRUCTURES USING HIGH RESOLUTION RADAR
J. H. Richter, E. E. Gossard, and D. R. Jensen *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16105# Lille Univ. (France). Lab. d'Optique Atmospherique.
ANALYSIS OF RADIOMETRIC INFRARED SEA TEMPERATURE MEASUREMENTS
P. Y. Deschamps, P. Lecomte, and J. C. Vanhoutte *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 9 p refs In FRENCH (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16106# Lille Univ. (France). Lab. d'Optique Atmospherique.
ANALYSIS OF RADIOMETRIC INFRARED MEASUREMENTS ON CLOUD TEMPERATURES AND STRUCTURES
Y. Fouquart and J. Lenoble *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 8 p refs In FRENCH (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16107# National Environmental Satellite Center, Washington, D.C.
FACTORS AFFECTING THE ACCURACY OF SEA SURFACE TEMPERATURE MEASUREMENTS FROM ITOS-SR DATA
J. Leese, W. Pichel, B. Goddard, and R. Brower *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 13 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16109# Kansas Univ., Lawrence. Center for Research, Inc.
EFFECT OF ANGULAR VARIATION ON TERRAIN SPECTRAL REFLECTIVITY
Dwight D. Egbert and Fawwaz T. Ulaby *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)
(Contract DAAK02-68-C-0089)
Avail: NTIS HC $6.00/MF $0.95

N72-16111# Kansas Univ., Lawrence. Dept. of Geography.
AN ANALYSIS OF MULTISPECTRAL IMAGERY FOR TROPICAL LAND USE DISCRIMATION
Roland D. Mower *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 16 p refs (See N72-16085 07-07)
(Contract DI-14-08-0001-12077)
Avail: NTIS HC $6.00/MF $0.95

N72-16112# TRW Systems Group, Redondo Beach, Calif.
SEA BRIGHTNESS TEMPERATURES AT MICROWAVE FREQUENCIES
R. J. Wagner and P. J. Lynch *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 16 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16113# Air Force Cambridge Research Labs., Bedford, Mass.
STATISTICAL METHODS OF INDIRECT PROBING OF THE ATMOSPHERE
V. J. Falcone, Jr. and K. Mano *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-16282* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
IMPACT MEASURING TECHNIQUE Patent
Donald H. Humes, inventor (to NASA) Issued 20 Sep. 1971 3 p Filed 26 Nov. 1968
(NASA-Case-LAR-10913; US-Patent-3,605,482; US-Patent-Appl-SN-779160-; US-Patent-Class-7312) Avail: US Patent Office CSCL 14B

A method of measuring the size of hypervelocity projectiles at the time of impact upon a target is described. This is accomplished by photographing the silhouetted image formed of the projectile by the impact flash along a line of view at a small angle from its line of flight.

Official Gazette of the U.S. Patent Office

N72-16283* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CATERPILLAR MICRO POSITIONER Patent
Ewald E. Schmidt, inventor (to NASA) Issued 28 Sep. 1971 4 p Filed 24 Sep. 1969
(NASA-Case-GSC-10780-1; US-Patent-3,608,409; US-Patent-Appl-SN-860493; US-Patent-Class-82-24R) Avail: US Patent Office CSCL 14B

A caterpillar micropositioner for use in an aspherical or similar machine is described. The micropositioner includes front and rear sliding holders and an electromechanical or other incremental driver. The driver connects the front and rear sliding holders and incrementally moves one holder with respect to the other holder. An outwardly extending tool is attached to the front holder. Electromagnetic holding means are held in each of the sliding holders and alternately energized to hold one of the holders in a fixed position while the other holder is moved. In addition, a flex ring is provided and coupled to the front and rear holders so as to place the driver under compression, thereby eliminating slack or play from the various mechanical interconnections between the driver and the holders and from the driver per se. Official Gazette of the U.S. Patent Office

N72-16284 European Space Research Organization, Paris (France).
DIRECTORY OF EUROPEAN ACTIVITIES IN THE REMOTE SENSING OF EARTH RESOURCES
Nov. 1971 80 p
Avail: Issuing Activity

A directory of European activities in the remote sensing of earth resources was compiled to provide information on the European organizations and institutions actively involved in the remote sensing of earth resources. A common format was used to present information on the different institutions, the principal investigators, the experimental programs, the sensors, and remote platforms. Cooperative programs existing between European institutions and NASA are discussed, in particular for the earth resources technology satellite and Skylab earth resources experiment package programs. Author (ESRO)

N72-16285*# Comar Space/Defense Corp., Birmingham, Mich.
POTATO RESPIROMETER EXPERIMENT SO61 Final Technical Report
P. C. Taudvin and T. A. Szpakowski 30 Sep. 1971 53 p refs
(Contract NAS9-9302)
(NASA-CR-115351; TR71-111) Avail: NTIS CSCL 14B

The design and manufacture of a respirometer for measuring the oxygen consumption rate of a respiring potato sprout in a Skylab experiment is reported. The device monitors low gravity effects on the biorhythmicity of organisms during space flight. Several experimental runs using bench mounted flight hardware units were inconclusive due to room temperature induced artifacts. G.G.

N72-16286# Aeronautical Research Labs., Melbourne (Australia).
CONSIDERATION OF THREE MODERN NON-DESTRUCTIVE TEST TECHNIQUES
I. G. Scott Jun. 1971 16 p refs
(ARL/MET-Note-75) Avail: NTIS

Studies were made of three possible techniques suitable for use in NDT, namely the transducerless generation of ultrasound, the use of radioactive gas, and microwave testing. The first is the very early stages of development, the second was shown to be relatively successful but requires equipment which is not readily available, and the third method is limited to the use with nonconducting materials. Author

N72-16287*# General Electric Co., Houston, Tex. Apollo and Ground Systems.
CHECKOUT SYSTEMS: SUMMARY REPORT FOR THE UNIVERSAL CONTROL AND DISPLAY CONSOLE
Jul. 1971 30 p Original contains color illustrations
(Contract NAS9-11140)
(NASA-CR-115350) Avail: NTIS CSCL 14B

The development of a unified test equipment checkout concept based on a universal control and display console system is discussed. The checkout requirements are analyzed for the shuttle and space station. Capability, size, utilization requirements and specifications of the ground checkout system are made on the basis of engineering trade-off studies. Recommendations related to the attainment of overall unified test equipment conceptual goals and objectives are submitted. Author

N72-16288*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF EDDY-CURRENT PROXIMITY DEVICES FOR MEASURING THIN POTASSIUM FILM THICKNESSES
Armen S. Asadourian Washington Feb. 1972 18 p refs
(NASA-TM-X-2494; E-6631) Avail: NTIS CSCL 14B

Two eddy current proximity probe systems were tested over a range of 0 to 508 micrometers (0 to 20 mils) of simulated potassium film thicknesses for simulated temperatures of 66 C (150 F), 232 C (450 F), and 666 C (1230 F). The results of short time calibration tests are presented. Instrument drift was a problem throughout the testing and, without correction, may limit the use of such systems to short periods of time. Additional development will be required prior to their being usable as practical instrumentation systems. Author

N72-16289*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
TRACER SENSITIVE TAPES Final Technical Report
W. H. Burrows and W. H. Burrows 3 Nov. 1971 35 p refs
(Contract NAS8-26759; Proj. A-1308)
(NASA-CR-123501) Avail: NTIS CSCL 14B

A leak detection system has been developed, consisting of a tape that can be wrapped around possible leak sites on a system pressurized with air or gaseous nitrogen. Carbon monoxide, at a level of 100 to 1000 parts per million is used as a trace gas in the pressurized system. The sensitive element of the tape is palladium chloride supported on specially prepared silica gel and specially dried. At a CO level of 100 ppm and a leak rate of 10-20 ml/hr, discoloration of the sensitive element is observed in 1.5 to 3 min. The tape and trace gas are compatible with aerospace hardware, safe to handle, and economically reasonable to produce and handle. Author

N72-16290# Lockheed Missiles and Space Co., Palo Alto, Calif.
LANGMUIR PROBE FOR ROCKET INVESTIGATIONS OF THE IONOSPHERE
Iu. B. Burakov, V. I. Stiazhkin, and Iu. K. Chasovitin [1971] 13 p refs Transl. into ENGLISH from "Fizicheskie Protessy v Verkhnei Atmosfere Zemli, Trudy 16" Inst. of Exptl. Meteorol. Moscow, Gidrometeoizdat., 1970 p 47-61
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A Langmuir probe for rocket measurements of ionospheric electron concentration and temperature is described, and the first experimental results obtained on an MR-12 flight are presented. Details are given on the components and operation of the instrument and its subsystems, and schematic diagrams are included. During the flight test on 30 March 1968, the rocket reached an altitude of 170 km; the electrometer amplifiers operated normally over the measuring phase of the trajectory, from approximately second 57 to second 355. Graphs were constructed to show electron temperature profiles, altitude change in rocket housing potential, and electron concentration profile. The agreement with ground-based observations was good. N.E.N.

N72-16291# Safety in Mines Research Establishment, Red Hill (England).
A TUNGSTEN WIRE RESISTANCE THERMOMETER FOR USE IN SMALL GASEOUS JETS

A. ODell 1970 24 p refs
(SMRE-RR-270; UDC-536.531:536.462) Avail: NTIS; SMRE 40p

Various configurations of a tungsten wire resistance thermometer were examined with a view to measuring temperatures up to 2000 C in a short duration pulsed gas jet. Single wires either straddling or immersed in the jet were not sufficiently accurate, but better results might be obtained with two wires of different lengths, which allow the end effects to be cancelled. The use of two-wire probes was restricted to jets emerging from narrow slots. Author

N72-16292*# Martin Marietta Corp., Denver, Colo.
STUDY OF PAYLOAD SENSOR CONTAMINATION
F. Jack Smith and Stanley Podlaseck [1971] 62 p
(Contract NAS1-10763)
(NASA-CR-112014) Avail: NTIS CSCL 14B

Epoxy/glass test specimens representing Scout fourth and fifth stage motor casings were prepared and studied in a test program designed to determine the relative contamination contributed to payload sensors located near the motor casings. The relative contamination detected in the test program was dependent on several factors, including: (1) distance of test specimen to sensor, (2) sensor temperature, (3) geometric position of the sensor (relative to test specimen), (4)test specimen temperature, (5) chemical composition of the test specimen, (6) sensor function, and (7) additional materials (such as adhesive-backed aluminum tape) added to the test specimens. The thermal characteristics and the decomposition and outgassing products were determined. These data were used to better understand the relative contamination data from the remote sensor testing. Author

N72-16293# Danish Meteorological Inst., Charlottenlund.
LONG TERM STABILITY OF A FERRITE CORE FLUXGATE MAGNETOMETER IN HIGH FIELD
F. Primdahl and W. R. Darker (Dept. of Energy, Mines and Resources, Ottawa) 1971 10 p refs Sponsored by NRC of Can., by Can. Govt., and by Danish Govt.
(R-25; ISBN-87-7478-041-7) Avail: NTIS

A 9 months comparison between a single component fluxgate and a proton magnetometer has been made. The fluxgate sensor was oriented parallel to the total field so that the output was directly comparable to a proton magnetometer reading. During the period the total drift of the fluxgate magnetometer baseline was +35 gamma. Author

N72-16294# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
EXPERIMENTAL STUDY OF STRAIN GAUGE HIGH PRECISION DYNAMOMETERS AT THE ONERA MODANE TEST CENTRE
Maurice Dubois 1971 23 p refs In ENGLISH and FRENCH Presented at the 2d Meeting of the Intern. Meas. Confederation, The Hague, 14-16 Sep. 1971
(ONERA-TP-995) Avail: NTIS

A study was undertaken to aid in designing standard high performance strain gage dynamometers. A calibration bench was used as a reference standard. Among other constraints, determination of the elastic properties of the various parts (metallic frame, bonds, gages) was essential, for accuracy is limited mainly by hysteresis and creep defects. Five alloys and three types of gages were tested. In the best combination, elastic defects did not exceed a ratio of 10 to the -4th power in the - 15 to + 45 hectobar stress range. A minimum stress of 2 X 10 to the -4th power hectobars could be detected. Author

N72-16295# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
MARTENSITE TRANSFORMATION DETECTION IN CRYOGENIC STEELS (MAGNETOMETER DEVELOPMENT)
F. R. Fickett Dec. 1971 30 p refs
(NAEC Proj. Order 1-8022)
(NBS-TN-613) Avail: SOD $0.40 as SD-C13.46:613

The design criteria for a magnetometer device developed to determine the martensite concentration in 304 stainless steel are presented. Specifically, the device is designed to monitor the cold tank of an airborne liquid oxygen container which is subject to periodic stress pulses. The amount of martensite is relatable to the plastic strain and thus provides a mechanism for the prediction of impending failure. The magnetometer is an excitation coil-Hall effect system, and is versatile in design. It is relatively insensitive to thermal and mechanical shock, and is easily capable of detecting martensite at the 1% level. Author

N72-16296# Rome Univ. (Italy). School of Aerospace Engineering.
REMOTE ATTITUDE SENSING TECHNIQUE FOR SPACE APPLICATIONS
Giorgio Ravelli Nov. 1970 31 p refs Presented at 21st Intern. Astronaut. Congr., Costanza, Italy, 4-10 Oct. 1970
(Rept-31) Avail: NTIS

An attitude sensing technique, designed to solve some of the problems encountered in using complex equipment for space communications, is described. This solution allows a significant decrease in the complexity of the onboard equipment, reduced in effect to a single transmitting system. The receiving and processing systems which provide the angular information are located at the ground terminal. The sensor mode of operation and the criteria followed for the selection of the coding process providing best working conditions, using standard electronic components both for the transmitting and receiving systems, are discussed in detail. An error analysis is carried out to evaluate the effects of asymmetrics in the transmitting system. Error curves for the various asymmetries are computed and presented in diagrams. The behavior of the sensor receiver in presence of noise is analyzed. Author

N72-16297# Oak Ridge Gaseous Diffusion Plant, Tenn. Isotropic Analysis Dept.
SOLID STATE AUTOMATIC BEAM POSITIONER FOR MASS SPECTROMETERS
H. C. Jones 16 Aug. 1971 7 p refs
(Contract W-7405-eng-26)
(K-1817) Avail: NTIS

An all-solid-state electronic beam positioner for isotopic ratio mass spectrometers has been developed and operated for several months without requiring service or adjustment. Low frequency modulation of the spectrometer ion accelerating potential with phase sensitive detection of beam position is used to apply an automatic correction signal to the accelerating potential and to maintain precise beam position in the collector slit. The operational amplifiers, power supply, and unijunction transistor oscillator utilized in the instrument are of all-solid-state design. Author (NSA)

N72-16298# Sandia Labs., Albuquerque, N.Mex.
FRIZZ: A HIGH VOLTAGE IMPULSE TESTER
T. H. Martin Jun. 1971 45 p refs Sponsored by AEC
(SC-RR-710341) Avail: NTIS

A pulsed voltage generator, called Frizz, was designed and constructed, and is being used as a voltage source for electrical surface studies of various materials. Frizz generates a nominal 800 kV, 100 nsec pulse of variable risetime from 5 to 50 nsec which is applied to dielectric test samples in a vacuum chamber. Author

N72-16299# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INFORMATION PROPERTIES OF PARTICLE TELESCOPE CONSISTING OF MULTIPLEX SCINTILLATION COUNTERS
L. M. Soroko 1971 16 p refs In RUSSIAN; ENGLISH summary
(JINR-P13-5896) Avail: AEC Depository Libraries

The particle telescope consisting of two multiplex Hadamard-transform scintillation counters is described. Each scintillator is set up with many-element scintillators which are surrounded by light-guides and four photomultipliers. Four coincidence circuits register the four groups of events. The coincidence countings define the intensity of the angular correlation events from the two particle ones. And the angular discrimination of the events to be measured is equal to the angle which subtends the only one element-scintillator of the multiplex scintillator of the multiplex scintillation counter. Author (NSA)

N72-16300# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
TRACK CHAMBER WITH THE CHARGE MULTIPLICATION INSIDE THE FILM ELECTRODES
V. I. Nikanorov, A. F. Pisarev, and G. I. Selivanov 1971 10 p refs In RUSSIAN
(JINR-P13-5780) Avail: AEC Depository Libraries

Charge multiplication, observed in porous dielectrical and semiconductor films, when supplying electrical field, is considered from the point of view of construction of coordinate chamber and counters for charged particle with recording basing on this effect. The variant of construction of track chamber using the boundary luminescence of media is also considered.
Author (NSA)

N72-16301# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CHARGE MULTIPLICATION IN THE LIQUID FILLED FILAMENT COUNTER
A. F. Pisarev Jun. 1971 16 p refs In RUSSIAN
(JINR-P13-5838) Avail: AEC Depository Libraries

The conditions are considered under which singular discharge points appear in the filament particle counters filled with liquid. It is shown that microroughness and microbubbles on the filament effect greatly the appearance of the local discharges. To stabilize the coefficient of the electron multiplication it is suggested to use in the counters a filament of optimum diameter, covered with a thin layer of dielectric of weak conductivity. It is advisable to use in the counters as working substance multiatomic liquids and mixtures with a monatomic liquid. The process of the electron multiplication in the counters is analyzed for a new method of feeding by bipole momenta and by high-frequency field. Common ratios, describing the operation of these counters, are established. Author (NSA)

N72-16302# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
USE OF THE HIGH VOLTAGE ELECTRON MICROSCOPE TO SIMULATE FAST NEUTRON INDUCED VOID SWELLING IN METALS
D. I. R. Norris Jan. 1971 22 p refs
(RD1B/N-1879) Avail: AEC Depository Libraries

Electron irradiation with the beam of a high voltage electron microscope can be used to produce void growth in metals, simulating the effect of high dose neutron irradiation. The advantages of the technique are the high dose rate, the relative simplicity of electron irradiation, and the ability to make observations during irradiation. Problems of determining the vacancy creation rate are discussed. Studies of void growth behavior are illustrated by results for stainless steel and for nickel. The roles of the moving dislocations and the surfaces are discussed. Author (NSA)

N72-16303# Rutherford High Energy Lab., Chilton (England).
CALIBRATION OF IMAGE-PLANE DIGITIZERS
G. P. Gopal Jul. 1971 10 p refs
(RHEL/R-223) Avail: AEC Depository Libraries

A new system of calibration of digitizers is described and details of the procedure and the computer program used are given. The system is general in its application to conventional measuring machines, but is mainly used to calibrate image digitizers. Calibration of digitizers with lens or film-plane shifts is systematically handled in the system. Author (NSA)

N72-16304# Institute of Nuclear Physics, Krakow (Poland).
APPARATUS FOR MEASUREMENT OF ION CONCENTRATION IN THE AIR
Z. Jura, Z. Krzystek, B. Niziol, and Z. Zakrocki 1971 32 p refs In POLISH; ENGLISH summary
(INP-748) Avail: AEC Depository Libraries

An exact specification of an apparatus for continuous registration of the concentration of atmospheric ions is presented. Preliminary results obtained from the measurements carried out in a closed space are given. The apparatus consists of an ionometer whose construction is similar to the spectrometer of ion motility, a high quality electrometer, a feeding system, and a recorder. The measurements show that mainly positive ions with a motility of approximately 1.4 sq cm/Vsec and 0.34 sq cm/Vsec, and negative ions with a motility of approximately 2.3 sq cm/Vsec and 0.33 sq cm/Vsec are present in the air of a closed space in the motility range of greater than 0.2 sq cm/Vsec. Author

N72-16305# Institute of Nuclear Physics, Krakow (Poland).
ADIABATIC LOW-TEMPERATURE CALORIMETER FOR SPECIFIC HEAT MEASUREMENTS OF SOLID AND LIQUIDS IN TEMPERATURE RANGE 77 K TO 400 K
Jacek Mayer and Tadeusz Waluga 1971 18 p refs
(INP-750) Avail: AEC Depository Libraries

The construction of an adiabatic low temperature calorimeter is described. The results of the following measurements are presented: (a) calibration of the calorimetric vessel in a temperature range 80 K to 300 K, and (b) the specific heat curve for ammonium bromide in a temperature range 124 K to 285 K. A good agreement with the results of either authors was obtained. Author

N72-16306# Goodyear Atomic Corp., Piketon, Ohio.
SECOND-ORDER REFOCUSING 15-INCH MASS SPECTROMETER FOR ULTRA PRECISE ISOTOPIC RATIO MEASUREMENTS OF URANIUM HEXAFLUORIDE SAMPLES
G. F. Kauffman, J. Lang, and W. E. Martin 15 Jul. 1971 65 p refs
(Contract AT(33-2)-1)
(GAT-655) Avail: NTIS

The relationships between the precision of isotopic ratio measurements and mass spectrometer resolving power are discussed, and a high resolution mass spectrometer capable of ultra-precise isotope ratio measurements of uranium hexafluoride samples is described. The instrument is a single focusing, 15-inch radius, 90 degree deflection mass spectrometer. The important design features are the use of normal circle, second order refocusing pole boundaries and an analyzer tube geometry that exactly compensates for the effects of the magnet fringing fields. The internal precision of the instrument is such that the limit of error of the ratio of mole ratios of a sample pair is plus or minus 0.00014 per determination at the 95 percent confidence level. Author (NSA)

N72-16307# California Univ., Berkeley. Lawrence Radiation Lab.
SMALL X-RAY TUBES FOR ENERGY DISPERSIVE ANALYSIS USING SEMICONDUCTOR SPECTROMETERS
J. M. Jaklevic, R. D. Giauque, D. F. Malone, and W. L. Searles 16 Jul. 1971 13 p refs Presented at the 20th Ann. Conf. on Appl. of X-Ray Anal., Denver, Colo., 11 Aug. 1971
(Contract W-7405-eng-48)
(LBL-10; Conf-710802-5) Avail: NTIS

The possibility of using low power X-ray tubes as exciting sources for energy dispersive fluoroscence analysis is discussed. The principal advantage to X-ray tubes is the ability to produce X-ray fluxes to three orders of magnitude higher than those

obtained with more convenient radioisotope sources while dissipating only a few watts in the tube. Furthermore, the variety of possible anode materials and range of currents in the tube make possible an optimum choice of exciting energy and intensity for particular applications. Using either X-ray filtering techniques or multiple fluorescence geometries, it is possible to significantly reduce the bremsstrahlung background relative to characteristic radiation. Author (NSA)

N72-16308# Mound Lab., Miamisburg, Ohio.
EVALUATION OF THE USE OF A QUANTITATIVE IMAGE ANALYZER TO DETERMINE MICROHARDNESS VALUES
P. E. Teaney and P. E. Selle 1971 20 p Presented at 4th Ann. Meeting of the Intern. Metallographic Soc., Denver, 21 Sep. 1971
(Contract AT(33-1)-Gen-53)
(MLM-OP-71007; Conf-710902-6) Avail: NTIS

The use of a quantitative image analyzer to determine microhardness values was investigated. Microhardness traverses were made across chemically polished, partially oxidized T-111 alloy specimens and microhardness values were obtained from both area and diagonal readings. These values were then compared to those obtained by conventional optical measurements. The data obtained by the various methods are compared and the advantages and disadvantages such as accuracy, time requirements, versatility, and limitations of particular methods are discussed. Author

N72-16309# Iowa State Univ. of Science and Technology, Ames.
AN OPTICAL MIXING SPECTROSCOPIC STUDY OF INTERFACIAL FLUCTUATIONS Ph.D. Thesis
Frederick John Dechow Aug. 1971 120 p refs
(Contract W-7405-eng-82)
(IS-T-494) Avail: NTIS

An optical heterodyne spectrometer has been developed to detect the Brillouin spectra associated with the interaction of light and random surface ripples. The experimental values for the ripplon frequencies substantially agree with the values obtained theoretically from the capillary ripple dispersion equations. The experimental values for the line shape of the Brillouin spectra are in the same range as those estimated theoretically. Further improvements are suggested to increase the agreement between theory and experiment. Author

N72-16310# Danish Research Centre for Applied Electronics, Copenhagen.
MEASUREMENT OF LAYER THICKNESS. AN INVESTIGATION OF SOME EXISTING METHODS OF MEASURING LAYER THICKNESS WITH INDICATION OF THEIR FIELDS OF APPLICATION
J. Bruun Jun. 1971 53 p In DANISH; ENGLISH summary
(ECR-21) Avail: NTIS

Some methods for determining coating thickness are described, including radiometric and optical methods. Problems arising when measuring the thickness of multilayer coatings and also thick film circuit coatings using the betascope are considered, and the application of the betascope to varnish coating measurement is examined. Methods of measuring transparent coating thickness using the light section microscope are discussed. The influence of base roughness on the coating quality is evaluated. ESRO

N72-16311# Laboratoire de Recherches Balistiques et Aerodynamiques, Vernon (France).
RESULTS OF A TWO-YEAR PRESERVATION STUDY OF THE KODAK BIMAT MX 731 PROCESSING FILM [SYNTHESE D'UNE CONSERVATION DE DEUX ANS DU FILM DE TRAITEMENT KODAK BIMAT MX 731]
M. Clement 30 Aug. 1971 18 p refs In FRENCH Sponsored by Direc. de Rech. et Moyens d'Essais
(LRBA-NT-9/71/SET/OP) Avail: NTIS

Monthly tests were carried out on Kodak Bimat MX 731 processing films over a storage period of two years at 4 C under a pressure of 50 torrs of nitrogen and in maximum humidity. The tests included visual inspection, sensitograms with a Macbeth densitometer, and determination of the aerial index exposure. ESRO

N72-16312# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab, Central de Recherches.
STUDY OF AN ABSOLUTE GRAVIMETER BASED ON INTERFEROMETRY IN COHERENT OPTICS Final Report [ETUDE D'UN GRAVIMETRE ABSOLU FONDE SUR L'INTERFEROMETRIE EN OPTIQUE COHERENTE]
M. Chartier 16 Dec. 1970 49 p In FRENCH Sponsored by Direc. de Rech. et Moyens d'Essais
(LCR-DR-1-70-191/1/R) Avail: NTIS

The development of the components needed for a transportable, absolute gravimeter with an accuracy better than one milligal is described. Particular attention is paid to the subassembly, to limit the measurement shift, due to the rotation of the reference trihedral during downwards movement. The initial positioning device is described as well as the chronometer. Results given by the prototype device are discussed. ESRO

N72-16313# National Physical Lab., Teddington (England). Div. of Quantum Metrology.
NEW REFERENCE TABLES FOR PLATINUM 10% RHODIUM/PLATINUM AND PLATINUM 13% RHODIUM/-PLATINUM THERMOCOUPLES (IPTS-68)
T. J. Quinn and T. R. D. Chandler Dec. 1971 121 p
(NPL-QU-21) Avail: NTIS

As a result of the introduction of the IPTS-68 it became necessary to revise the existing reference tables for platinum 10% rhodium/platinum and platinum 13% rhodium/platinum thermocouples. In view of the differences which existed between the tables commonly used in the United Kingdom (published by the British Standards Institution as BS 1826) and those used in the USA (published by the National Bureau of Standards, Washington, as NBS 561), the opportunity was taken to produce a new unified set of reference tables common to both the United Kingdom and the USA. A detailed set of the new reference tables for platinum 10% rhodium/platinum and platinum 13% rhodium/platinum thermocouples is provided. Author (ESRO)

N72-16314# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
SURVEY OF CURRENT DEVELOPMENTS IN PEM/OEN DETECTORS AND CONSIDERATION OF THEIR USEFULNESS FOR SATELLITE APPLICATION Final Report
B. Paul Paris ESRO Aug. 1971 75 p refs
(Contract ESTEC-1021/70)
(ESRO-CR-42) Avail: NTIS

The theory of the optically induced Ettingshausen Nerust effect (OEN) for use in photoelectromagnetic detectors is developed, and applications are surveyed. The dependence of the figures of merit, especially that of the detectivity on the material parameters is evaluated for selected frequency ranges. With anisotropic InSb-NiSb and a modulation frequency of 1 KHz a detectivity of greater than 10 million is attainable for a selected wavelength range. Bismuth shows a somewhat higher detectivity but poor response compared to InSb-NiSb. Special designs such as a polarization detector for laser communication, a two-dimensional ranging detector, and a multifrequency chopping technique for use as a quasi-array detector are described. A comparison is made with the passive photobolometer; possible use as a satellite horizon crossing indicator is discussed. ESRO

N72-16315# Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
INTEGRATED ENGINE INSTRUMENTATION SYSTEM STUDY: SELECTED STUDIES ON ENERGY MANAGEMENT Final Report, 1 May 1970 - 30 Jun. 1971

D. C. Sederstrom, N. R. Zagalsky, R. L. Schultz, L. J. Mueller, and R. P. Irons, Jr. Sep. 1972 116 p refs
(Contract N00014-67-C-0101; NR Proj. 213-070)
(AD-731713; Rept-12591-FR-2(R)) Avail: NTIS CSCL 05/8

A hybrid simulation of an F4 aircraft was developed for the purpose of evaluating display concepts and human operator techniques and capabilities in manual energy management. Time savings in achieving energy gains with the aids provided as compared with Flight Manual methods and reduction in pilot workloads were measured. Maximum-range prediction and minimum-time intercept, as elements of an energy management system, were investigated. Several approaches to inflight calibration were studied. Benefits of optimal fuel estimation by means of Kalman filtering and by linear blending of fuel flow and fuel quantity measurements were determined. Author (GRA)

N72-16316# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
A DIGITAL CASSETTE TAPE RECORDER FOR TIMESHARING RECORDING
William V. Bailey Jul. 1971 79 p refs
(Contract F44620-68-C-0015; AF Proj. 9769)
(AD-732317; AFOSR-71-2748TR; Rept-61102F; Rept-681304) Avail: NTIS CSCL 14/3

A digital cassette tape recorder has been successfully designed. An Ampex Micro 9 tape recorder modified by addition of an FAE Instrument Corporation electromagnetic clutch-brake, design of power supply for tape drive and supporting analog and digital circuitry are described in detail. Two designs, a feasibility design and prototype design are offered. Specific suggestions for improved design and further theoretical investigations indicate a commercial unit could come from this research. Author (GRA)

N72-16317# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AN ANALYTICAL STUDY OF THE SPLIT HOPKINSON BAR TECHNIQUE FOR STRAIN RATE DEPENDENT MATERIAL BEHAVIOR Summary Report, Sep. 1970 - Jun. 1971
Theodore Nicholas Aug. 1971 34 p refs
(Task-735106)
(AD-732196; AFML-TR-71-155) Avail: NTIS CSCL 14/2

The validity of the split Hopkinson bar technique for determining dynamic material behavior is examined for specimen materials which exhibit strain rate dependent mechanical behavior. The torsional mode of deformation is chosen as more closely representing a one-dimensional state of stress. The details of the propagation and reflection of stress waves within the specimen are studied using a numerical procedure based on the method of characteristics. Reconstituted stress strain curves calculated from the conventional analysis of the split Hopkinson bar experiment are compared with actual material behavior for a number of simulated experiments involving variations in input stress, gage length, material behavior, and static stress strain curves including statically prestressed materials. The validity of the experimental technique is discussed and limitations on its use are delineated. Author (GRA)

N72-16318# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
DEVELOPMENT OF A HIGH SPEED BIAXIAL TESTING MACHINE Final Report, May 1970 - Mar. 1971
Ulric S. Lindholm, Lester M. Yeakley, and Andrew Nagy Jul. 1971 30 p refs
(Contract F33615-70-C-1443; Task-735106)
(AD-731823; AFML-TR-71-149) Avail: NTIS CSCL 14/2

The development of a new, high-speed biaxial materials testing facility is described. The machine combines axial and torsional loading, with each independent load axis under closed-loop servo control. A new feature of this facility is the development of a compound linear-torsional hydraulic actuator which reduces the mechanical compliance and backlash inherent in previous systems. The resultant 'stiffer' machine improves the control of deformation or load at high testing speeds. The system components and operating specifications are described. Author (GRA)

N72-16319# Utah State Univ., Logan. Electro-Dynamics Lab.
THREE CHANNEL SCANNING RADIOMETER, MODEL WS-1 Scientific Interim Report
Clair L. Wyatt 1 Jun. 1971 59 p
(Contract F19628-67-C-0322; Task-8658-03-01)
(AD-731228; AFCRL-70-0384; SR-2) Avail: NTIS CSCL 14/2

A three-channel scanning radiometer was launched into the equatorial night sky to obtain atmospheric emissions at 1.0, 1.27, and 1.6 micrometer wavelengths. The combined effect of ACS spin and instrument scan motion provided 22 vertical scans for each of six rocket rotations. Successful launch provided good data on the hydroxyl and oxygen emission bands. Interesting variations in heights of the emission layers were observed. Author (GRA)

N72-16320# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
OPTICAL METHOD FOR CONDUCTING NONDESTRUCTIVE TESTING OF FUEL FILTER ELEMENTS Summary Report, Jul. - Sep. 1970
W. Melvyn Roquemore and Charles R. Martel Jun. 1971 52 p refs
(Task-304805; AF Proj. 3048)
(AD-731237; AFAPL-TR-71-16) Avail: NTIS CSCL 14/2

Two optical methods have been investigated for use as a nondestructive test method for use with filter-separator coalescer elements. Shadowgraphs and holographic interferograms have been shown to be useful for examining the flow variations of a gas flowing through a filter element. The test gas, having an index of refraction substantially different from that of air, refracts the light near the filter surface and permits gas flow variations through the filter media to be observed. It is anticipated that the shape of the test gas boundary layer and the boundary layer thickness will provide information on the media's porosity, voids, and plugged areas. Initial experiments have confirmed the sensitivity of the two optical methods, because a 1/16-inch diameter hole drilled through an element was easily detected. However, additional work is needed to establish correlation between the optical-gas flow, nondestructive test method and naturally occurring filter-element defects. Author (GRA)

N72-16321# Woods Hole Oceanographic Institution, Mass.
FOUR HYDROPHONE ARRAY FOR ACOUSTIC THREE-DIMENSIONAL LOCATION
William A. Watkins and William E. Schevill Oct. 1971 91 p refs
(Contract N00014-66-C-0241; NR Proj. 083-004)
(AD-732042; WHOI-Ref-71-60) Avail: NTIS CSCL 20/1

The report describes a non-rigid, floating, four-hydrophone array that can give accurate three-dimensional locations for certain underwater sound sources, particularly for those that are close. For more distant sounds, the array can indicate good directions (bearings) but range is liable to be uncertain. A system for concurrent calibration permits periodic reassessment of hydrophone positions. Author (GRA)

N72-16322# Army Electronics Command, Fort Monmouth, N.J. Photo Optics Technical Area.
COLOR DEVELOPERS SUITABLE FOR PROCESSING EKTACOLOR-S
Walter M. Morosky, Marilyn Levy, and Ronald E. Hemingway Jun. 1971 29 p refs
(DA Proj. 1S6-62703-A-176)
(AD-731472; ECOM-3433) Avail: NTIS CSCL 14/5

A study was made of the effect of variation in the concentration of developer constituents on the characteristic curves of Eastman Kodak Ektacolor-S film. Potassium Bromide, Sodium Hydroxide, CD-3, Benzyl Alcohol, and Sodium Sulfite

were among the ingredients studied. Several formulas suitable for the development of Ektacolor-S at 75F for 14 minutes are described. Author (GRA)

N72-16323# Geological Survey, McLean, Va. Topographic Div.
AERIAL CAMERAS, CAMERA CALIBRATION, AND AERIAL PHOTOGRAPHY
R. Welch May 1971 82 p refs Presented at the Ann. Photogrammetry Short Course (11th), Urbana, Ill., 31 May - 11 Jun. 1971
(PB-202009; USGS-TD-71-003) Avail: NTIS CSCL 14E

The basic components of a photogrammetric mapping camera consist of the camera mount, camera body and lens cone, shutter, lens, magazine, and intervalometer/viewfinder. The characteristics of modern camera lenses are discussed, and guidelines are given for selecting the proper aerial camera to meet a specific aerial photographic task. The objectives of camera calibration are to establish the geometric and imaging characteristics of the camera system. The practical aspects of achieving these objectives are brought out in a detail discussion of the multicollimator method of calibration used by the Geological Survey. A number of photographic parameters and natural elements, besides the camera itself, that affect the recording of photographic detail are described. Author (GRA)

N72-16324# Illinois Univ., Urbana. Dept. of Civil Engineering.
PHOTOGRAMMETRY AS A TOOL FOR HYDRAULIC SURFACE STUDIES
Wolfgang Faig Aug. 1971 32 p refs
(PB-202280; UILU-ENG-71-2022; Photogrammetry-Ser-31) Avail: NTIS CSCL 08H

The optical behavior of water surfaces is described, and the feasibility of using photogrammetric techniques to determine water depths is investigated. GRA

N72-16325# Owens-Illinois, Inc., Toledo, Ohio.
THREE-COLOR PLASMA-PANEL DISPLAY DEVICE Quarterly Report, 1 Jan. - 31 Mar. 1971
F. H. Brown, W. D. Petty, C. W. Salisbury, and M. Tamm Zayac Aug. 1971 54 p
(Contract DAAB07-70-C-0243; DA Proj. 7910.22.703.05.01)
(AD-731419; ECOM-0243-3; QR-3) Avail: NTIS CSCL 09/5

The objectives of this program are to design, fabricate, and evaluate a plasma-panel display device having a three-color capability and to investigate and develop a technique for operating such a device with at least three levels of intensity. Red, green, and blue phosphors were selected for incorporation into three-color, triad DIGIVUE(R) display/memory panels. It was found that multicolor panels containing Xe gas and having phosphor projecting into the gas volume require the phosphor spots to have a donut geometry which keeps the area of electrode overlap free of phosphor. A high-voltage square-wave driver was completed which is capable of addressing Xe-filled panels. Optical crosstalk was measured and found to be significant. Modifications of panel structure intended to reduce optical crosstalk were begun. In particular, abrasion of the inside surface of the back plate was found to decrease optical crosstalk. Procedures for determining the change in wall-voltage (Delta V(W)) versus the cell-voltage (V(C)) are reviewed. Typical Delta V(W)-versus-V(C)-versus-time characteristics were measured, and their significance is discussed. Author (GRA)

N72-16326# Harry Diamond Labs., Washington, D.C.
HDL YAW SONDE INSTRUMENTATION
Robert E. Elmore Sep. 1971 26 p refs
(Task-1W-26301-A-30100; HDL Proj. IMS00)
(AD-732342; HDL-TM-71-19; AMCMS-Code-522A:11.62500) Avail: NTIS CSCL 14/2

An electro-optical system has been developed by the Harry Diamond Laboratories to telemeter in-flight rotational characteristics of artillery rounds and rockets without modification to the round. It is a small, self-contained, gun-rugged unit---designated the HDL Yaw Sonde---that can be screwed into any artillery round that accepts standard fuzes. (A 20in., 12-thread fuze is defined as U. S. Standard 1A by ABCA Army Standary 101A.) Special versions of the unit have also been developed for other rounds. Operation of the system is based on the admission of sunlight through a pinhole, the light being swept past a V-slot as the round rotates. Complete rotational information is obtained by proper interpretation of the signals generated by the light beam. The HDL Yaw Sonde system has been determined adaptable to artillery rounds, Navy Bom-Roc rockets, and Air Force bomblets. Accurate data on spin and yaw have been obtained on a variety of tests at different high-g accelerations. Author (GRA)

N72-16327# Aerospace Corp., El Segundo, Calif. Lab. Operations.
FARADAY CUP DETECTORS Technical Report, Jul. 1962 - Jun. 1970
Henry H. Hilton and John R. Stevens 15 Jun. 1971 130 p refs
(Contract F04701-71-C-0172)
(AD-732284; TR-0172(2260-20)-3; SAMSO-TR-71-222) Avail: NTIS CSCL 18/4

The study of low-energy charged particles, in the range from 1 to 10 keV, through the use of Faraday cup detectors is documented. In 1961, the design of the first Faraday cup was initiated, and the final Faraday cup was placed in orbit in 1968. The development of these instruments is described, and observations from successful launches are discussed.
Author (GRA)

N72-16328# Hughes Research Labs., Malibu, Calif.
BI-STABLE ELECTROPHOTOGRAPHIC DISPLAY DEVICE Final Technical Report, Feb. 1970 - Jun. 1971
Glenn D. Roberston, Jr. Oct. 1971 95 p refs
(Contract F30602-69-C-0157)
(AD-732301; RADC-TR-71-210) Avail: NTIS CSCL 09/5

A study has been performed of the feasibility of using a Sustained Electron Bombardment Induced Conductivity (SEBIC) layer to control a light modulating electrochromic (EC) film in a projection display device. Such control was demonstrated but a variety of practical problems has prevented fabrication of a usable device. A major problem area is the interlayer needed to separate the EC and SEBIC films. Author (GRA)

N72-16782 Endevco Corp., Pasadena, Calif. Dynamic Instrument Div.
A PRACTICAL APPLICATION OF ACCELEROMETER CALIBRATIONS
R. R. Bouche *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 1-9 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16783 Agricultural Research Service, Davis, Calif. Transportation and Facilities Research Div.
DESIGNING AN INSTRUMENTED TEST EGG FOR DETECTING IMPACT BREAKAGE
William L. Shupe and Robert M. Lake *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 11-16 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16784 Army Tank-Automotive Command, Warren, Mich.
AN ACCLEROMETER DESIGN USING FERROFLUID ULTRASONIC INTERFEROMETRY
Jack G. Parks *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1971 p 17-24 refs (See

N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16794 Raytheon Co., Sudbury, Mass.
DESCRIPTION OF A SHOCK AND VIBRATION DISPLACEMENT AMPLIFIER
D. Cerasuolo and J. Chin *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 149-154 (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16796 Sandia Labs., Albuquerque, N.Mex. Heat, Plasma, Climatic, Towers Div.
GAS SPRING FIRING AND THE SOFT RECOVERY OF A HARD-WIRE INSTRUMENTED 155 MM PROJECTILE
S. L. Fluent *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 175-186 Sponsored by AEC (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

N72-16833 Littleton Research and Engineering Corp., Mass.
A SYSTEMATIC APPROACH TO SHOCK HARDENING
J. L. Lipeles and D. Hoffman (Naval Ammunition Depot) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5, Dec. 1970 p 77-88 (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16858*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF LIQUID OSCILLATIONS ON THE LM PROPELLANT QUANTITY GAUGE SYSTEM
M. Rimer and D. G. Stephens *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 181-194 refs Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N. Y. (See N72-16842 07-32)
(NASA-TM-X-67491) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 14B

N72-16237# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AN INSTRUMENT FOR PRECISE MEASUREMENTS OF SMALL DIFFERENCES OF THE GRAVITY
Rudolf Brein *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 5-9 refs (See N72-16236 07-13)
Avail: NTIS

N72-16242# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ON THE OPTIMUM NUMBER OF STAR IMAGES IN REDUCING OPTICAL SATELLITE OBSERVATIONS FROM CAMERAS OF SMALL FOCAL DISTANCE
Hermann Sessger *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 33-45 refs (See N72-16236 07-13)
Avail: NTIS

N72-16243# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
EXPERIMENTS WITH A DOUBLE CAMERA FOR SATELLITE OBSERVATIONS
Waldemar Wassermann *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 47-51 (See N72-16236 07-13)
Avail: NTIS

N72-16089# Communications Research Centre, Ottawa (Ontario).
THEORY AND FIELD TESTS OF A MICROWAVE RADIOMETER FOR DETERMINING SEA ICE THICKNESS
A. W. Adey *In* AGARD Propagation Limitations in Remote sensing Oct. 1971 10 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16103*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
INFRARED AND MULTISPECTRAL REMOTE SENSING
M. R. Holter *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 19 p refs Original Contains Color Illustrations (See N72-16085 07-07)
(NASA-TM-X-67496) Avail: NTIS HC $6.00/MF $0.95 CSCL 14B

N72-16104# Electronique et de Physique Laboratoire d' Appliquees, Paris (France).
FUNDAMENTAL AND PRACTICAL LIMITS OF REMOTE INFRARED IMAGING INSTRUMENTS OPERATING BETWEEN 2, 5 AND 18 MICRONS
F. Desvignes *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 14 p refs In FRENCH; ENGLISH summary (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-16110# Army Engineer Topographic Labs., Fort Belvoir, Va.
THE USE OF COLOR AERIAL PHOTOGRAPHY IN THE RECONNAISSANCE OF SOILS AND ROCKS
Abraham Anson *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

N72-15968# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
VALUES AND UNITS IN FLIGHT DYNAMICS
E. Mewes *In its* Flight Mech. 1971 p 57-67 refs In GERMAN; ENGLISH summary (See N72-15963 07-02)
Avail: NTIS; DFVLR, Porz: 14,80 DM

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-16329* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TECHNIQUE OF DUPLICATING FRAGILE CORE Patent
Albert R. Philips and Richard F. Hellbaum, inventors (to NASA)
Issued 21 Sep. 1971 6 p Filed 30 Sep. 1968
(NASA-Case-XLA-07829; US-Patent-3,608,046; US-Patent-Appl-SN-763684; US-Patent-Class-264-221; US-Patent-Class-264-225; US-Patent-Class-264-227; US-Patent-Class-264/DIG.44) Avail: US Patent Office CSCL 13H

A method for fabricating individual and complete fluid circuit components is described. A three dimensional photosensitive plastic pattern is prepared for the desired circuit and is utilized for casting a disposable mold, and for forming a wax pattern or low melting metal alloy core from the mold. This core is then utilized to form the desired component mold in an epoxy resin casting. F.O.S.

N72-16330* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TUBE FABRICATING PROCESS Patent
John G. Davis, Jr., inventor (to NASA) Issued 21 Sep. 1971 5 p Filed 22 Oct. 1968
(NASA-Case-LAR-10203-1; US-Patent-3,607,495; US-Patent-Appl-SN-769592; US-Patent-Class-156-86; US-Patent-Class-156-84) Avail: US Patent Office CSCL 13H

A method of fabricating uniaxial filament reinforced plastic tubes is disclosed. Plies of uncured epoxy resin preimpregnated filament sheets are wrapped around a mandrel and a heat shrinkable sleeve is used to apply pressure against the plies while the epoxy resin is being cured.
Official Gazette of the U.S. Patent Office

N72-16331*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
TEST AND EVALUATION OF APOLLO 14 COMPOSITE CASTING DEMONSTRATION SPECIMENS AND FLIGHT AND CONTROL SAMPLES Final Report, 28 Dec. 1970 - 31 Aug. 1971
Richard C. Fabiniak and Thaddeus J. Fabiniak Sep. 1971 195 p refs
(Contract NAS8-27106)
(NASA-CR-61366; KE-3101-D-1) Avail: NTIS CSCL 13H

The results of experiments 1, 2, and 10 of the Apollo 14 composite casting demonstration are discussed. The purpose of the demonstration, with regard to samples 1 and 2, was to obtain preliminary data on the liquid phase sintering process in a weightless environment. With regard to sample 10, the purpose was to obtain preliminary information on how to achieve uniform dispersion of dense particles on a metal matrix by employing shaking modes or forces in the system when the metal matrix is molten. Results of the demonstrations were interpreted in a quantitative and qualitative manner. For experiment 1 it was found that the tungsten particles were redistributed more uniformly in the flight sample than in the control sample. Experiment 2 results indicate that complete melting may not have occured and thus a high degree of significance cannot be associated with the qualitative results relating to particle redistribution data. The particle-matrix system of experiment 10 was found to be nonwetting. Author

N72-16332*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROGRAM LISTING FOR THE RELIABILITY BLOCK DIAGRAM COMPUTATION PROGRAM OF JPL TECHNICAL REPORT 32-1543
Paul O. Chelson and R. Eric Eckstein 1 Dec. 1971 41 p
(Contract NAS7-100)
(NASA-CR-125541; JPL-TM-33-513) Avail: NTIS CSCL 14D

The computer program listing for the reliability block diagram computation program described in Reliability Computation From Reliability Block Diagrams is given. The program is written in FORTRAN 4 and is currently running on a Univac 1108. Each subroutine contains a description of its function.
Author

N72-16333*# National Aeronautics and Space Administration, Washington, D.C.
FASTENERS AND FASTENING TECHNIQUES: A COMPILATION Technology Utilization
22 p
(NASA-SP-5906(03)) Avail: NTIS CSCL 13E

Technology on fasteners and fastening devices is presented, as part of NASA's TU program to provide technical information on devices, methods, and techniques resulting from aerospace research. The material is divided into two sections which include: (1) data concerning a selected group of fasteners and concept for fasteners such as locking devices, couplings, and connect and release mechanisms; and (2) discussions on a number of fastening techniques such as those for mounting panel lamps, clamping flange bolts, stretching fasteners, and transferring fuel from a tanker to another vehicle. D.L.G.

N72-16334*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF AN ARCHED OUTER-RACE BALL BEARING CONSIDERING CENTRIFUGAL FORCES
Bernard J. Hamrock and William J. Anderson [1972] 23 p refs Proposed for presentation at Lubrication Conf., New York, 9-12 Oct. 1972; cosponsored by ASME and AM Soc. of Lubrication Engr.
(NASA-TM-X-68002; E-6767) Avail: NTIS CSCL 13I

A Newton-Raphson method of iteration was used in evaluating the radial and axial projection of the distance between the ball center and the outer raceway groove curvature center (V and W). Fatigue life evaluations were made. The similar analysis of a conventional bearing can be directly obtained from the arched bearing analysis by simply letting the amount of arching be zero (g = 0) and not considering equations related to the unloaded half of the outer race. The analysis was applied to a 150-mm angular contact ball bearing. Results for life, contact loads, and angles are shown for a conventional bearing (g = 0) and two arched bearings (g = 0.127 mm (0.005 in.), and 0.254 mm (0.010 in.)). The results indicate that an arched bearing is highly desirable for high speed applications. In particular, for a DN value of 3 million (20,000 rpm) and an applied axial load of 4448 N (1000 lb), an arched bearing shows an improvement in life of 306 percent over that of a conventional bearing. At 4.2 million DN (28,000 rpm), the corresponding improvement is 340 percent. It was also found for low speeds, the arched bearing does not offer the advantages that it does for high speed applications. Author

N72-16335*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF HIGH SPEED BALL BEARINGS WITH LEAD PLATED RETAINERS IN LIQUID HYDROGEN FOR POTENTIAL USE IN A RADIATION ENVIRONMENT
Donald W. Wisander, David E. Brewe, and Herbert W. Scibbe Washington Feb. 1972 13 p refs
(NASA-TN-D-6653; E-6642) Avail: NTIS CSCL 13K

Ball bearings (40-mm bore) with lead coated, aluminum-bronze retainers were operated successfully in liquid hydrogen at 30,000 rpm under a thrust load of 1780 newtons (400 lb) for running times up to 15 hours. The lead transfer films on the bearing surfaces prevented galling of bearing components. The lead coated retainers used in this investigation show promise for use in the high radiation environments, where polytetrafluoroethylene (PTFE) based materials are not suitable. Failure was a result of the loss of lead lubricant on the retainer-inner-land and ball-pocket surfaces. The longest bearing life (15 hr) was achieved with a lead coating thickness of 50 micrometers (0.002 in.) on the retainer. Other bearings had lives of 2 to 6 hours.
Author

N72-16336*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RADIOFREQUENCY-SPUTTERED COATINGS FOR LUBRICATION SYSTEM COMPONENTS AND OTHER COMPLEX SURFACES
Talivaldis Spalvins Washington Feb. 1972 9 p refs
(NASA-TM-X-2498; E-6679) Avail: NTIS CSCL 11H

Irregularly shaped surfaces, such as lubrication system components (ball bearings, seals, gears, etc.), can be coated on all surfaces, including irregular shapes, when radiofrequency sputtering is used. When the specimen is properly located with

respect to the sputtering target, the sputtered material covers the entire surface of the object irrespective of its geometrical configuration. An adherent, dense film is formed. The film thickness varies from 20 to 50 percent on, for example, a hearing cage or race depending on its geometry. When sputtered solid film lubricants such as molybdenum disulfide are used, a film thickness only of the order of 10 to the minus 7th power m (thousands of angstroms) is required at the contacting areas. It is only essential to determine the required film thickness at the critical areas in need of lubrication. The sections outside the areas to be lubricated fall within the thickness deviation range of 20 to 50 percent, which still constitutes a negligible change respect to tolerance requirements. Author

N72-16337*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC BEHAVIOR OF AIR LUBRICATED PIVOTED-PAD JOURNAL-BEARING, ROTOR SYSTEM. 2: PIVOT CONSIDERATION AND PAD MASS
Zolton N. Nemeth Washington Feb. 1972 42 p refs
(NASA-TN-D-6606; E-6336) Avail: NTIS CSCL 13I

Rotor bearing dynamic tests were conducted with tilting-pad journal bearings having three different pad masses and two different pivot geometries. The rotor was vertically mounted and supported by two three-pad tilting-pad gas journal bearings and a simple externally pressurized thrust bearing. The bearing pads were 5.1 cm (2.02 in.) in diameter and 2.8 cm (1.5 in.) long. The length to diameter ratio was 0.75. One pad was mounted on a flexible diaphragm. The bearing supply pressure ranged from 0 to 690 kilonewtons per square meter (0 to 100 psig), and speeds ranged to 38,500 rpm. Heavy mass pad tilting-pad assemblies produced three rotor-bearing resonances above the first two rotor critical speeds. Lower supply pressure eliminated the resonances. The resonances were oriented primarily in the direction normal to the diaphragm. Author

N72-16338# Joint Publications Research Service, Washington, D.C.
SEMIAUTOMATIC WELDING OF BUTT JOINTS OF TITANIUM ALLOYS OF GREAT THICKNESS WITHOUT DRESSING OF EDGES
V. L. Russo 26 Jan. 1972 7 p refs Transl. into ENGLISH from Svarochn. Proizvodstvo (Moscow), no. 10, Oct. 1971 p 20-21
(JPRS-55026; UDC-621.791:669.295; CSO-01484/72-W) Avail: NTIS

A technology was developed for high productivity semiautomatic welding in a narrow slit, producing butt joints of titanium alloys from 20 to 100 mm thick. In demonstrating the technology, a modified PGT-2 semiautomatic welding device with a fuseable electrode was used. The welded joints produced by utilizing this technology were of high quality, and tests of the specimens indicated an equality of strength of base metal and seam. D.L.G.

N72-16339# Boeing Scientific Research Labs., Seattle, Wash. Aerospace Group.
STRESS DISTRIBUTION AND DISPLACEMENTS IN A LUBRICATED ELASTIC SEAL
F. Edward Ehlers Sep. 1971 43 p refs
(D180-14141-1) Avail: NTIS

Milne-Thomson's complex variable method of plane elastic stress is used to study the stresses and displacements in an elastic seal of rectangular cross section. Surfaces of the seal touching the shaft and housing are assumed to be lubricated and therefore shear forces vanish on all boundaries of the seal. The solution of the integral equation for a semi-infinite seal is found and detailed calculations of the stresses and displacements in the vicinity of the air gap near the shaft are presented. A similar integral equation results for the finite rectangular cross section seal. Relations for calculating stress and displacements near the boundaries of the rectangular seal are presented. The pressure distribution on the fixed wall for the finite seal is found to be similar to that for the semi-infinite seal except for an additional rise in the normal stress near the inside corner of the seal. The solution for the semi-infinite seal in a coaxial housing also was formulated. Author

N72-16340# National Research Council of Canada, Ottawa (Ontario).
ANALYTICAL CONSIDERATION OF THE CRYSTAL ELONGATIONS IN CONTINUOUS CHIP FORMATION DURING THE MACHINING OF METALLIC MATERIALS
G. Koehler 1971 31 p refs Transl. into ENGLISH from CIRP Ann. (West Germany), v. 17, no. 1, 1969 p 51-63
(NRC-TT-1512) Avail: NTIS

A systematic classification of deformations occurring in chip formation and chip crystal elongation is given. The equations for analytically calculating the direction of crystal elongation are discussed. The mathematical relationships which exist between the angles describing the main direction of crystal elongation and selected parameters of chip formation (such as rake angle, shear angle and chip compression) are derived. The equation for the experimentally determined angle of crystal elongation (defined as the angle between the chip underside and the direction of crystal elongation) is given. Author

N72-16341# Bendix Corp., Kansas City, Mo.
AFT SUPPORT MACHINED FROM TITANIUM
J. M. Robb May 1971 25 p
(Contract AT(29-1)-613)
(BDX-613-525) Avail: NTIS

The aft support used on a large missile component type assembly is a complex, thin walled structural member machined from titanium alloy 6AL-4V. It has threads and flanges for attachment and the titanium alloy provides the cantilever strength required in the next assembly application. Tolerances are extremely close and difficult to measure due to part size and flexibility. An initial production yield of less than 10 percent was obtained only by extensive rework. The development of adequate inspection methods enabled a thorough evaluation of process sequences, fixturing techniques, cutting tools, and process control procedures. This evaluation and subsequent modifications to the process resulted in a yield of more than 90 percent acceptable product. The process thus developed and recorded should be of significant benefit in developing future processes for machining similar thin wall titanium parts. Author

N72-16342# Reactive Metals, Inc., Ashtabula, Ohio. Extrusion Plant.
PRECISION EXTRUSION OF I AND E ELEMENTS
Feb. 1971 21 p ref
(Contract AT(30-1)-1405)
(RMI-L-48) Avail: NTIS

Results of investigations on the feasibility of precision extrusion of Hanford internally and externally cooled (I & E) fuel elements are presented. Experiments designed to determine optimum mandrel parameters are described along with extrusion methods. It was concluded that I & E precision extrusion is not a recommended method at present. NSA

N72-16343# Bendix Corp., Kansas City, Mo.
A STUDY OF THE SHELF AGING CHARACTERISTICS OF Y-3333 CELLULAR SILICONE Interim Report
G. E. Martinette Jul. 1971 51 p Revised
(Contract AT(29-1)-613)
(BDX-613-375-Rev.; PDO-6984549; UC-25; R1452) Avail: NTIS

Various material handling and storage techniques were investigated in an attempt to lengthen the effective shelf life of a cellular silicone material which had exhibited a 2-week shelf life when handled in a normal manner. A significant increase in the useful shelf life was effected by compressing the uncured, as-received material into flat sheets and storing the sheets under refrigeration (40 F) until just prior to configuration molding. Author

N72-16344# Institutt for Atomenergi, Kjeller (Norway).
PROPERTIES AND MANUFACTURE OF ZIRCALOY CLADDING TUBES
K. Videm, S. Aas, L. Lunde, K. Lunde, A. Granlund, and R. Rose May 1971 17 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P-291; Conf-710901-196) Avail: AEC Depository Libraries

The specifications of Zircaloy cladding tubes are discussed in light of in-pile behavior and of the fabrication steps which determine the properties of the tubes. In general, increased strength is achieved at the expense of ductility. By adjusting the relative reduction of the cross section and wall thickness of the tube and the annealing treatment, the anisotropy of Zircaloy can be utilized to achieve improved properties in the directions of maximum stress. Preferred orientation can also be used to suppress the tendency to neck radially for small deformations in the tangential direction. The effects of various surface treatments on the quality of the surface and on the behavior of the material have been studied. The present trend in cladding tube specifications seems to be towards stricter requirements to dimensional tolerances, mechanical properties, and surface roughness. More stringent requirements can be taken care of with the present production techniques, and will have only a minor influence upon tubing costs provided that a high raw material gain can be maintained. Author (NSA)

N72-16345# Institute of Nuclear Research, Warsaw (Poland).
RADIOGRAPHICAL CONTROL OF THICKWALLED WELDS AND CASTINGS BY USING OF BETATRON
J. Janiczek, R. Kielsznia, and M. Wolski 1970 77 p In POLISH; ENGLISH summary
(INR-1204/II/B) Avail: AEC Depository Libraries

The operating principles of betatrons are given and the problem of using betatrons for radiographic investigations is discussed. Experiments were performed using the Nuclear Research Institute betatron, and conclusions were formulated concerning the range of application of commercially available radiographic films to industrial radiographic control using betatrons. Some types of betatrons and betatron laboratories are described. Author (NSA)

N72-16346# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
SCANNING ELECTRON MICROSCOPY OF FRACTURES IN WELDED STRUCTURES
Carl D. Lundin and Robert K. Bennett 14 Sep. 1971 19 p refs
(Contract W-7405-Eng-26)
(Y-DA-4280) Avail: NTIS

The scanning electron microscope has been used to observe and characterize the morphology of the surfaces of weld defects, discontinuities, and fractures. These observations and characterizations have enabled the definition of the mechanism of formaton of weld defects and have provided information as to the factors leading to the formation of weld fractures. In nickel-base alloys hot cracking is easily and clearly recognized by scanning electron fractography. In most cases a liquid film is an integral part of the cracking mechanism, and other evidence suggests that at times two liquid films of differing compositions and properties play a part in the mechanism of crack formation. Evidence is also available which suggests the possiblity of a stress-rupture mechanism of hot crack formation in which a previously solidified film plays a role. Author (NSA)

N72-16347# European Space Research and Technology Center, Noordwijk (Netherlands).
MATERIALS INFORMATION AT ESTEC
J. Dauphin Paris ESRO Sep. 1971 19 p refs
(ESRO-TM-131-ESTEC) Avail: NTIS

Quality control of materials for ESRO satellites is discussed, emphasizing thermal vacuum tests. Materials data at ESTEC are listed. ESRO

N72-16348# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANIZED WELDING OF TITANIUM AND ITS ALLOYS
S. M. Gurevich 27 Jul. 1971 17 p Transl. into ENGLISH of the publ. "Mekhanizirovannaya Svarka Titana i Yego Splavov' Moscow, 1968 p 3-10
(Contract F33657-71-D-0057; FTD Proj. 60108)
(AD-731906; FTD-HC-23-378-71) Avail: NTIS CSCL 13/8

The article reviews a process of automatic welding of titanium and its alloys. GRA

N72-16349# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF CONJUGATE PROCESSES ON RESISTANCE OF WELD METAL TO BRITTLE FRACTURE IN WELDING OF STEELS WITH DIFFERENT CHEMICAL COMPOSITION
Yu. V. Shirshov and N. N. Prokhorov 27 Jul. 1971 15 p refs Transl. into ENGLISH from Tr. Mosk. Vysshee Tekhn. Uchilische (USSR), no. 133, 1969 p 79-86
(FTD Proj. 60107; DIA-Task-T68-01-02)
(AD-731897; FTD-MT-24-54-71) Avail: NTIS CSCL 13/8

An analysis was made of the effect of welding conditions on the operational reliability of the weld metal in welding of steels of different chemical composition. Author (GRA)

N72-16350# Midwest Research Inst., Kansas City, Mo.
COMPARISONS OF EXPERIMENTAL AND THEORETICAL DYNAMIC ROTOR BEARING BEHAVIOR USING GAS LUBRICATION Technical Report, Dec. 1968 - May 1970
Ronald D. Dayton Nov. 1971 57 p refs
(Contract F33615-69-C-1265; AF Proj. 3048)
(AD-732211; AFAPL-TR-71-44) Avail: NTIS CSCL 13/9

The report presents the results of an investigation into the adequacy of presently available theory in predicting the dynamic behavior of a rotor supported in hydrostatic and hydrodynamic gas lubricated journal bearings. Measurements of critical speeds, threshold of instability speeds, gas flow rates, and rotor whirl frequencies for several rotors supported in hydrostatic and hydrodynamic journal bearings were made and compared to theoretical predictions. Variables investigated were bearing load, bearing supply pressure, bearing and gas temperature, and type of bearing supply gas. Good agreement between the experimental and theoretical results was obtained. Author (GRA)

N72-16351# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME SOLDERING QUESTIONS OF REFRACTORY METALS
Yu. S. Dolgov 27 Jul. 1971 25 p refs Transl. into ENGLISH from Tr. Mosk. Vysshee Tekh. Uchilishche (Moscow), no. 132, 1969 p 187-198
(FTD Proj. 60108; DIA-Task-T65-01-82; DIA-Task-T65-01-83)
(AD-732282; FTD-MT-24-752-71) Avail: NTIS CSCL 13/8

One of the difficulties when soldering molybdenum with oxidized copper by silver solder is the oxidation of the molybdenum and the failure of wetting. The reason for oxidation is the transfer of oxygen from the copper to the surface of the molybdenum, which is confirmed by calculation. The effective means combating the oxidation of the molybdenum is the utilization of a copper foil layer, which creates an obstacle for oxygen transfer and completely eliminates oxidation. When soldering porous metals, especially tungsten, the selection of a solder should be made considering the strength of its interaction with the material of a porous body. Preliminary calculations in the proposed simplified scheme made it possible to shorten the labor input of experimental operations. A comparison of zirconium and titanium with respect to the time necessary for the crystallization of the solder in the capillaries of porous tungsten indicated the obvious advantages of titanium. Author (GRA)

N72-16352# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.
FOIL BEARING DESIGN MANUAL
A. Eshel, W. A. Gross, L. Light, and P. Szego 30 Sep. 1971 87 p refs
(Contract N00014-71-C-0001; NR Proj. 062-297)
(AD-731393; RR-71-18) Avail: NTIS CSCL 13/9

A compendium of theoretical and experimental results, available at the present in the field of foil bearings, is presented. Design formulae and brief explanations of concepts are given for self-acting and externally pressurized foil-bearings, with reference to applications in the transport of flexible media and the support of rotating machinery. Author (GRA)

N72-16353# Naval Civil Engineering Lab., Port Hueneme, Calif.
SUBMERSIBLE DIVER TOOL POWER SOURCES: ELECTRO-HYDRAULIC AND CRYOGENIC PNEUMATIC Technical Note, Jul. 1970 - Jun. 1971
S. A. Black Aug. 1971 43 p
(Proj. YF38-535-003-01-002)
(AD-731358; NCEL-TN-1174) Avail: NTIS CSCL 13/9

Two self-contained and completely submersible power supplies for powering diver operated hand held tools are discussed; one power supply operates pneumatic tools while the other operates closed cycle oil hydraulic tools. Operational evaluations were performed with Navy qualified divers using hand held tools powered by the modules to find whether both concepts were effective as submersible power sources. Refinements necessary are delineated. Author (GRA)

N72-16354# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
CONSOLIDATION AND CARRYING CASE FOR THE AGM-69 SRAM OPERATIONAL TEST LAUNCH KIT
Rudolph F. Quinter Oct. 1971 21 p
(AFPEA Proj. 71-28-C-6(1))
(AD-732288; DSPEA-4) Avail: NTIS CSCL 13/4

The operational test launch kit for the AGM-69 (SRAM) missile is composed of seven components which are presently packaged in individual containers. To facilitate ease of handling and use, it was decided to develop a consolidation and carrying case for the units. Prototype containers and items were fabricated by the Air Force Packaging Evaluation Agency to verify the container cushioning design. When tested in accordance with Federal Test Method Standard No. 101B, satisfactory results were obtained; thus it was concluded that the containers would provide the intended protection. Author (GRA)

N72-16355# Picatinny Arsenal, Dover, N.J.
EVALUATION OF THE ADHESIVE BONDING PROCESSES USED IN HELICOPTER MANUFACTURE. PART 1: DURABILITY OF ADHESIVE BONDS OBTAINED AS A RESULT OF PROCESSES USED IN THE UH-1 HELICOPTER
Raymond F. Wegman, Marie C. Ross, Stanley A. Slota, and Edward S. Duda Sep. 1971 111 p refs
(AD-732353; PA-TR-4186; AMCMS-Code-4010.28.9.02003) Avail: NTIS CSCL 13/8

The methods used to prepare adherends for components of UH-1 aircraft (prior to bonding) were evaluated for their effect upon the durability of the bonded joint. The phosphate-fluoride method for titanium produces a surface which, when bonded, was 7.5 to 10 times more durable than joints prepared from titanium surfaces that were alkaline cleaned. Upon aging, the surface structure of the phosphate-fluoride treated specimens showed signs of conversion to the less durable structure found on the alkaline-cleaned titanium. The method used to anodize aluminum produced a surface which, when bonded, exhibited essentially the same durability as the bonds using phosphate-fluoride-etched titanium. Bonds to glass-resin-composite adherends are as durable as the composite itself and failures were found to be interlaminar. Author (GRA)

N72-16356# Harry Diamond Labs., Washington, D.C.
FLUIDIC POWER SUPPLIES FOR HIGH-PERFORMANCE POINT DETONATING FUZES VALUE ENGINEERING STUDY
Kenneth E. Woodward and H. Steven Kimmel Aug. 1971 43 p refs
(DA Proj. 1T0-62114-A-644; HDL Proj. V98V1)
(AD-732341; HDL-TM-71-18) Avail: NTIS CSCL 13/7

The report describes a value-engineering study conducted on both reed- and modulating-type fluidic power supplies. Although these power supplies have several applications, their application in the high-performance, point-detonating (HP-PD) fuze was chosen to constrain the study with regard to performance, use, and procurement. The results of this VE study show that the modulating-type power supply, using molded plastic body parts, is the most promising alternative for future production emphasis. Estimated procurement costs for this design have been reduced approximately 51 percent as a result of this study. The modulating-type supply is likely to cost $1.00 or less per unit when procured in quantities of 1-million units. In quantities of 10-million units, a unit cost of $0.50 or less is possible. Author (GRA)

N72-16357# Southwest Research Inst., San Antonio, Tex.
AUTOMATIC FIRE PROTECTION SYSTEM FOR MANNED HYPERBARIC CHAMBERS. PHASE 2: PROTOTYPE DESIGN, FABRICATION AND TEST. VOLUME A: SYSTEM DESIGN AND TEST Final Report, 1 Jul. 1969 - 15 Feb. 1971
Lester A. Eggleston and William R. Herrera Feb. 1971 100 p refs
(Contract N62399-69-C-0045; YF Proj. 38-534-014-01-001; SWRI Proj. 03-2641)
(AD-731680; NCEL-CR-71.006-Vol-A) Avail: NTIS CSCL 13/12

Based upon the Phase I results, a prototype automatic fire protection system was constructed and tested at SwRI using compressed air and helium air mixtures up to 8 atmospheres. Many problems were encountered before rapid, and reliable infrared (IR) detection could be assured. Other difficulties were encountered with an ionized particle (IP) detector for combustion products, which although not yet completely satisfactory shows an attractive potential for detecting serious overheat situations. Considerable fundamental work was done on this unit in diving atmospheres. A total of 264 tests were conducted. Extinguishment was satisfactory. The overall measured system responses from visible flame to the start of water discharge from the nozzles ranged from 1.3 to 2.4 seconds. With the system in optimum condition, the average response was 1.9 seconds. Author (GRA)

N72-16358# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
IMPROVED FATIGUE RESISTANCE OF Al-Zn-Mg-Cu (7075) ALLOYS THROUGH THERMOMECHANICAL PROCESSING Final Report, Jun. - Dec. 1970
Friedrich Ostermann Sep. 1971 30 p refs
(Task-735106)
(AD-732267; AFML-TR-71-121) Avail: NTIS CSCL 13/8

To decrease the accumulation of damage during long-life low stress cyclic loading, microstructures must accommodate inelastic deformation by homogeneous or dispersed slip rather than by localized slip concentrations. In age-hardening aluminum alloys this requirement can be met by introducing a dense and uniform dislocation forest through suitable thermomechanical treatments. Such a treatment was developed for Al-Zn-Mg-Cy (7075) alloys, involving a process cycle of solution annealing, partial aging, mechanical working and final aging. The fatigue properties (S-N curves) of commercial and high-purity 7075TMT are compared with conventional 7075-T651 properties; with zero mean stress and alternating stress to cause failure in 10 to the 7th power cycles is more than 25% higher for commercial-purity 7075TMT and almost 50% higher for high-purity 7075TMT. The results emphasize the importance of microstructural control when high fatigue resistance is required. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-16359*# Laval Univ. (Quebec). Quantum Electronics Lab.
RUBIDIUM GAS CELL STUDIES Semiannual Status Report, 1 Apr. - 30 Sep. 1971
Jacques Vanier Oct. 1971 13 p refs
(Grant NGR-52-133-001)
(NASA-CR-122342; SASR-3) Avail: NTIS CSCL 20E

The stability of Rb-87 optically pumped masers and Rb gas cells is examined. Descriptions are given of the technical procedures used in construction and the changes made to solve the problems encountered in the electronics of the systems.
E.H.W.

N72-16360# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
SINGLE-EXPOSURE IMAGING DEVICE FOR INFRARED AND SUBMILLIMETER WAVELENGTH LASER
F. Keilmann May 1971 32 p refs Prepared in cooperation with European At. Energy Commun.
(IPP-IV-18) Avail: AEC Depository Libraries

A detector for two-dimensional observations of infrared and submillimeter-wavelength radiation is described. It allowed mode structures and interference patterns to be imaged for the first time with the 337-micron radiation of an HCN laser. The image conversion effect is based firstly on radiation absorption by a metal film and secondly on temperature display presented by the color shift in a liquid crystal layer. Irrespective of the wavelength of the infrared radiation, full contrast is achieved at the input energy density of 0.004 J/sq cm. Single pictures can therefore be taken in short exposure times, viz., 10 to the minus 9th power sec at a wavelength of 10.6 microns (CO2-laser) or 10 to the minus 5th power sec at 337 microns (HCN laser). A spatial resolution of 100 line pairs per mm can be achieved if the exposure time is below 10 to the minus 4th power sec, which calls for a power density of at least 40 W/sq cm. Author (NSA)

N72-16361# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
NEODYMIUM GLASS LASER SYSTEM
H. Baumhacker Mar. 1971 94 p refs In GERMAN
(IPP-4/82) Avail: AEC Depository Libraries

A high power neodymium glass laser system used mainly for plasma generation is described. Several oscillators with various types of Q switches were developed. Each oscillator can be operated in series with several amplifier stages. Presently, the most powerful system, which consists of an oscillator Q-switched by a rotating mirror and three subsequent amplifiers, delivers pulses with a peak power of 5 GW and 25 nsec half-width.
Author (NSA)

N72-16362# Princeton Univ., N.J. Plasma Physics Lab.
USE OF LONG-WAVELENGTH, HIGH-POWERED LASERS FOR CONTROLLED THERMONUCLEAR FUSION
J. M. Dawson, R. E. Kidder, and A. Hertzberg Sep. 1971 38 p refs
(Contract AT(30-1)-1238)
(MATT-782) Avail: NTIS

The possibilities for applying low-frequency lasers, in particular the 10 micron CO2 laser, to the problem of controlled thermonuclear reaction are discussed. The 10 micron CO2 laser can be effective for heating plasmas in the density range of 10 to the 17th power to 10 to the 19th power up to a temperature of several KeV. If enough passes of the beam through the plasma can be achieved, effective heating at densities as low as 10 to the 16th power might occur. The development of powerful lasers for 100 micron radiation would make this a definite possibility. It appears that such a laser is a very versatile tool for producing plasma, and many possible plasma configurations can be evisioned. A number of possible fusion devices are presented. These merely represent examples of what might be considered, and are intended to give some feeling for what is possible. Possibilities both for full-scale working reactors and for doing significant experiments today are discussed. Author (NSA)

N72-16363# Harry Diamond Labs., Washington, D.C.
NEUTRAL GAS LASERS
Colin S. Willett Jul. 1971 128 p refs
(DA Proj. 1Td-61101-A-91-A; HDL Proj. ILR38)
(AD-731779; HDL-TR-1546) Avail: NTIS CSCL 20/5

Tables are given of all laser transitions in neutral atomic species reported up to August 1970. The tables include details of range of operation, product of, optimum pressure and tube diameter and type of excitation used to give laser oscillation. The following specific selective excitation mechanisms are discussed and graphically illustrated: excitation transfer, dissociative excitation transfer, optical pumping, electron impact, radiative cascade pumping, charge neutralization, and molecular photodissociation. Examples of each are given and referenced. Characteristics of two technologically important neutral gas lasers are fully described and illustrated. The references are specially selected to provide a source of information on selective excitation mechanisms in gas lasers. Author (GRA)

N72-16364# Ohio State Univ. Research Foundation, Columbus.
TECHNIQUES OF PARAMETRIC INTERACTIONS TO MILLIMETER AND SUB-MILLIMETER WAVES Final Report, 1 Jul. 1969 - 31 Mar. 1971
Hsiung Hsu Sep. 1971 19 p refs
(Contract DA-ARO(D)-31-124-G1170; OSURF Proj. 2858)
(AD-731831; OSURF-2858-2; AROD-7925-1-E) Avail: NTIS CSCL 20/12

Parametric interactions are a fundamental nonlinear process. These interactions are applicable to millimeter and submillimeter waves. This concept has now been extended to multiple scattering processes involving particles of an entirely different nature by using stimulated Brillouin scattering on photon-phonon interactions. Author (GRA)

N72-16365# Washington State Univ., Pullman. Dept. of Chemistry.
STRUCTURES AND DYNAMICS OF LUMINESCENT MATERIALS INCLUDING LASERS Final Report, 15 Sep. 1967 - 14 Sep. 1971
G. A. Crosby Oct. 1971 15 p refs
(Grant AF-AFOSR-1342-68; AF Proj. 9537)
(AD-732318; AFOSR-71-2734TR) Avail: NTIS CSCL 07/4

Firm strides have been made in the development of methods of synthesis and purification for obtaining optically pure transition-metal complexes. Also general rules were established which summarize, catalog, and quantify the behavior of luminescent transition-metal ions. A significant accomplishment has been the formulation of a semiempirical quantum mechanical model that satisfactorily accounts for the observed optical behavior of these molecules and supplies important information about the role of spin-orbit coupling in complexes of the 4d and 5d elements. A final step forward has been the prediction - and demonstration - that complexes can be produced having optical parameters that are sensitive to the environment and may be modulated by external fields. In addition several advances are reported in instrumentation and methods of data reduction, specifically the construction of an apparatus to measure photoluminescence quantum yields and the successful determination of the efficiencies for over twenty transition-metal complexes of 4d and 5d elements, as well as the development of reliable methods of measuring decay times of luminescent crystals, plastics, and powders in the range 2-300 K.
Author (GRA)

N72-16366# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INVESTIGATION OF MODE JUMPING IN A Q-SWITCHED RUBY LASER
Lawrence J. VandeKieft, William M. Frey, and Phillip W. Yunker Aug. 1971 18 p
(DA Proj. 1T0-61101-A-91-A)
(AD-731484; BRL-MR-2117) Avail: NTIS CSCL 20/5

The paper describes a possible method of determining the extent of intensity fluctuations within a laser beam as a function of time. It is applicable to very short pulses, approximately 20 nanoseconds in duration, as well as longer pulses and C.W. because the beam is not sequentially scanned. A given part of the beam cross section can be compared with any other part at all times during the pulse. The temporal stability of a Korad, Model K-1500 giant pulse ruby laser has been investigated. The near-field beam pattern was transformed by an image dissector into a one-dimensional image. This image was then swept across a photographic film; in this way the beam intensity distribution was recorded as a continuous function of time. From this record it was determined that mode jumping was not occurring.
Author (GRA)

N72-16367# Hughes Research Labs., Malibu, Calif.
DAMAGE THRESHOLD STUDIES IN LASER CRYSTALS: SELF-FOCUSING EXPERIMENTS AND ELECTRON HEATING THEORY Semiannual Report
Concetto R. Giuliano, Donald F. Dubois, and Gerald R. Rickel Jul. 1971 68 p refs
(Contract F19628-69-C-0277; ARPA Order 1434; AF Proj. 8693)
(AD-731226; AFCRL-71-0398; SAR-4) Avail: NTIS CSCL 20/5

Details of the temporal development of damage tracks are presented and discussed in terms of a self-focusing theory. The results of a number of streak camera photographs show that the damage track grows in a way which depends on the temporal behavior of the leading edge of the incident pulse. This work constitutes the first direct evidence for a moving self-focus in solids. A comparison with self-focusing theory is given and the importance of electrostriction is made evident. Damage thresholds in sapphire for lenses of different focal length are presented and compared with the results obtained for ruby in the last report. Also in this report damage with cylindrical lenses is discussed. An observation of rings in the beam profile of the focused laser beam is presented. The phenomenon which appears at points beyond the beam waist is a property of the ruby laser or possibly a combination of the laser and the lenses. This behavior could well be a general property of 'single mode' solid state lasers. Further theoretical effort has been devoted to the problem of heating of electrons in polar crystals by intense optical fields. A kinetic equation has been developed which appears to offer a basis for settling the question of electron heating. Author (GRA)

N72-16368# American Optical Co., Southbridge, Mass. Central Research Lab.
NEODYMIUM LASER GLASS IMPROVEMENT PROGRAM Technical Summary Report, 1 Jul. - 31 Dec. 1967
Richard F. Woodcock Jul. 1971 36 p
(Contract Nonr-3835(00); ARPA Order 306; Proj. 7300; Proj. DEFENDER)
(AD-731702; TR-598-11) Avail: NTIS CSCL 20/5

The report continues detailing efforts expended toward achieving a means for measuring the stress optical coefficients of laser glass test specimens using a 3-pinhole interferometer. The apparatus design and construction is discussed. The experimental procedure is delineated and some initial results are presented. Finally a theoretical analysis of tolerance studies of the interferometer is appended. Author (GRA)

N72-16369# SCICOM Inc., Huntsville, Ala.
MIXING PHENOMENA RELATED TO CW CHEMICAL LASERS
Alexander A. Hayday Jul. 1971 99 p refs
(Contract DAAH01-71-C-0218)
(AD-731475; RK-TR-71-16) Avail: NTIS CSCL 20/5

The report concludes a brief preliminary study on mixing phenomena related to continuous wave chemical laser injector systems. It is largely a survey of existing information on mixing of high and low speed, turbulent, chemically active gases. Several different flows that may occur near the cavity entrance are identified and reliability of available mixing models is assessed. Two main configurations are treated: mixing of parallel streams and mixing in cross-flows. Factors affecting the rapidity of mixing are given. Topics on mixing of parallel flows include: (1) supersonic-subsonic interactions of isobaric jets of significantly different molecular weights; (2) influence of highly exothermic reactions and transverse pressure gradients; (3) effects of adverse pressure gradients and the possibility of wake flows with base bleeding; (4) limitations of boundary layer mixing models. Interactions of perpendicularly oriented streams are discussed for both low speed flows and the case of a secondary jet issuing through a sonic orifice into a supersonic main stream. Methods for estimating penetration depth by the secondary jet are given and effectiveness of mixing in cross-flows is compared with the parallel flow configuration. Author (GRA)

N72-16370# Raytheon Co., Waltham, Mass. Special Microwave Devices Operation.
DEVELOPMENT AND FABRICATION OF A YAG LASER SYSTEM FOR STUDY OF MODE LOCKING AND PULSE CODING LASER OUTPUT Final Report, 1 Jan. - 1 Jul. 1971
Leorand J. Wargo 1 Jul. 1971 21 p
(Contract F19628-71-C-0053; Task-ILIR-9-70-01)
(AD-732229; SM-279; AFCRL-71-0471) Avail: NTIS CSCL 20/5

A special purpose, high repetition rate Nd:YAG laser system has been designed, developed and fabricated for use in experiments in mode locking and pulse coding. The system consists of a laser transmitter, power supply and cooler. The transmitter is a mechanically stabilized, 1 meter long optical cavity with a flash-pumped single cavity oscillator using a 1/4 in. x 2 in. Nd:YAG crystal, a KD callita prime P Pockels cell, and a 150 MHz mode-locking modulator cell. The system was successfully tested up to a repetition rate of 50 pps and a 100 nanosecond Q-switched output of 130 millijoules. Mode-locked pulses were measured at 0.8 nanoseconds. Author (GRA)

N72-16371# Massachusetts Inst. of Tech., Cambridge. Crystal Physics Lab.
PHONON ASSISTED LASER TRANSITIONS AND ENERGY TRANSFER IN RARE EARTH LASER CRYSTALS
Hans Petter Jenssen Sep. 1971 111 p refs
(Contracts N00014-67-A-0204-0044; ARPA SD-90; DAHC15-67-C-0222)
(AD-731742; TR-16) Avail: NTIS CSCL 20/5

An extensive study of energy transfer and phonon interaction in rare earth doped LiYF4 has been conducted. The trivalent rare earth ions Pr, Nd, Dy, Ho, Er, Tm and Yb were used as the optically active ions. $Y_2Ti_2O_7$, also doped with rare earth ions, was examined. A new technique for investigating energy transfer was used. Crystals with high enough concentration of sensitizer and activator ions to assure near neighbor pairs were used to measure transfer rates as a function of energy gap. An exponential dependence on energy gap was found. Efficient transfer was also observed in $Y_2Ti_2O_7$, which has inversion symmetry at the rare earth site and therefore no allowed electric dipole transitions. Author (GRA)

N72-16372# Avco-Everett Research Lab., Everett, Mass.
FOCUSING EXPERIMENTS WITH A HIGH POWER N2/CO2 LASER
James P. Reilly Oct. 1971 33 p refs
(Contract N00014-70-C-0429)
(AD-731682; AERL-RR-376; code-421) Avail: NTIS

CSCL 20/5

A high-power uniform electric discharge is used to produce laser action in a mixture of N2, CO2 and He. Stable and unstable resonator cavities have been used on this medium to extract large amounts of power in both single mode and multimode laser operation. At a given electrical power input and cavity coupling, no significant difference in power extraction from the cavity was measured between the stable and unstable resonators. When focused, the power output from the unstable resonator produced focal point spot sizes and energy densities consistent with near-diffraction limited single-mode operation.
Author (GRA)

N72-16373# Informatics TISCO, Inc., Riverdale, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 4 Interim Report, Apr. - Jun. 1971
Stuart G. Hibben 27 Aug. 1971 101 p refs
(Contract F44620-70-C-0081; ARPA Order 1622)
(AD-732244; AFOSR-71-2814TR; ARPA-Code-oF10; IR-4)
Avail: NTIS CSCL 20/5

The report covers the second quarter of 1971 with the major yield of information coming from the approximately 30 periodicals known to report the most advanced and interesting findings in Soviet laser technology. This as well as the previous three reports covers the following topics: (1) laser research -solid state, liquid, gas and chemical lasers; UV; components; nonlinear optics; spectroscopy of laser materials; short pulse generation; crystal growing; and general theory; (2) laser applications -- biological effects, communication, computer technology, holography, instrumentation, materials processing, and plasma generation.
Author (GRA)

N72-16788 TRW Systems Group, Redondo Beach, Calif.
SHOCK LOADING AND HOLOGRAPHIC INTERFEROMETRY IN NDT
R. L. Johnson, R. Aprahamian, and P. G. Bhuta *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 63-74 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

N72-16108# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ERBIUM LASER PROPAGATION IN A CO2 ATMOSPHERE IN THE NEAR INFRARED
Kenneth O. White, E. Howard Holt, Stuart A. Schleusener (New Mex. State Univ., Las Cruces), and Robert F. Calfee (NOAA, Boulder, Colo.) *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 5 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-16374 National Lending Library for Science and Technology, Boston Spa (England).
IN THE UKRAINE SCIENTIFIC RESEARCH INSTITUTE FOR SPECIAL STEELS, ALLOYS AND FERROALLOYS. IN THE ALL-UNION SCIENTIFIC RESEARCH INSTITUTE FOR THE ORGANISATION OF PRODUCTION AND LABOUR IN FERROUS METALLURGY
[1971] 5 p Transl. into ENGLISH from Stal (USSR), v. 7, 1971 p 670-671
(NLL-M-21189-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Developments in metallurgical processes and in workers' conditions are briefly reported. The use of exothermic mixtures improved the quality of stainless steels, and a step-wise homogenizing heating improved the quality of heat resistant, corrosion resistant, bearing steels. The mechanical properties of standard and free-cutting steels were compared and all free-cutting steels are recommended for state durability tests. Standards for the division and cooperation of labor, and basic trends and changes in the professional make-up of iron and steel workers are mentioned. A method for computing productivity in metallurgical plants was devised, and the essential economic components used in the calculation were analyzed.
N.E.N.

N72-16375 National Lending Library for Science and Technology, Boston Spa (England).
CORROSION AND PROTECTION OF METALLIC POWDERS
Y. Sendzimir and V. Gumovska 19 Nov. 1971 9 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 7, no. 2, 1971 p 118-125 In ENGLISH and RUSSIAN
(NLL-Trans-746-1048-(9022.401)) Avail: Natl Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The effects of dispersion and particle surface characteristics of metallic powders on their thermodynamic properties and reaction kinetics were studied. Improved methods of examining the corrosion processes and of protecting metallic powders and components against corrosion were proposed.
Author

N72-16376 National Lending Library for Science and Technology, Boston Spa (England).
INTERACTION OF Ni-Cr-Si-B COATING WITH STEEL DURING COATING PROCESS
E. A. Antonova, N. S. Andrushchenko, and L. M. Sinai 19 Nov. 1971 6 p refs Transl. into ENGLISH from Zashch. Metal. (USSR), v. 7, no. 2, 1971 p 137-142 In ENGLISH and RUSSIAN
(NLL-Trans-746-1047-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupon

The formation of protective coatings on carbon and alloy steels from a mixture of finely-dispersed powder base was investigated. During the dross method, the optimum temperature range of the coating process lies at the beginning of the melting range of the powder mixture and is from 980 to 1050 C. This provides a continuous layer, good adhesion, and minimum interaction with the substrate (reaction zone 20 to 30 microns). At temperatures of 1170 C and higher, contact interaction is expressed sharply (iron in the coating is 48% and more) due to the formation of a large amount of complex boride eutectics with the participation of the substrate.
Author

N72-16377 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF ALLOYING BY ALUMINIUM ON RESISTANCE OF 20Cr-40Ni ALLOY
O. A. Bannykh and A. I. Grigorev 19 Nov. 1971 4 p refs Transl. into ENGLISH from Zashchita Metal. (Moscow), v. 7, no. 2, 1971 p 161-164 In ENGLISH and RUSSIAN
(NLL-Trans-746-1049-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The peculiarities of prolonged oxidation of 20Cr-40Ni type alloys, alloyed with aluminum, under conditions of thermal cycling with heating to 900 and 1000 C were studied. Cylindrical samples (h = 15, d = 9 mm) were placed in a crucible and oxidized in an air atmosphere of electric-furnaces, cooled to room temperature and weighed after each 100 hours. Results indicate aluminium increases the oxidation rate of the 20Cr-40Ni alloy at 900 C. At 1000 C on the other hand, a favorable influence of aluminium on the heat resistance of the alloy is observed. In the alloy with 4.62% Al the rate of oxidation is minimal. Breaks are noted on the kinetic curve of alloy 1 close to 600 and 1700 hours of soaking. The curves of the alloys with aluminium have bends after approximately 600 hours of

oxidation and then they are left clearly expressed. At 1000 C there is no internal oxidation. Author

N72-16378 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF THERMOMAGNETIC TREATMENT ON INDUCED MAGNETIC ANISOTROPY IN PERMALLOY 50N
B. G. Livshits, V. I. Solodikhin, and A. N. Savich 19 Nov. 1971 4 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 31, no. 1, Jan. 1971 p 211-213 In RUSSIAN and ENGLISH
(NLL-Trans-746-1077-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effect of thermomagnetic treatment in a longitudinal magnetic field and in a magnetic field rotating in one and two mutually perpendicular planes on the formation of induced anisotropy of a 50 Ni-50 Fe alloy was studied. The induced anisotropy was studied on a polycrystalline sample in the shape of a sphere 12 mm in diameter. As a result of thermomagnetic treatment, single-axial magnetic anisotropy was induced in the longitudinal field in the sample. The magnetic anisotropy was not induced in the rotation plane of the field. The values of the induced anisotropy constant (K sub u), calculated according to the curves of the mechanical moment, are shown. A comparison of the values of K sub u shows that they are close during thermomagnetic treatment in the longitudinal and its rotating field. Treatment in the magnetic field, rotating in 2 mutually perpendicular planes, does not lead to the formation of any anisotropy. Author

N72-16379 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF MISCHMETAL ON CREEP RESISTANCE OF Cr BRONZES
M. I. Zamotorin and O. S. Mnushkin 19 Nov. 1971 7 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Moscow), no. 305, 1970 p 135-140 In ENGLISH and RUSSIAN
(NLL-Trans-746-981-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Eight ingots with a chromium content of approximately 0.5% and a mischmetal content of 0.002, 0.01, 0.02, 0.1, 0.2, 0.6, 1.0 and 2.0% are melted in a high-frequency furnace under a layer of calcined carbon and were cast into a flat mold, after which they were rolled at 750 - 900 C, to a thickness of 25mm and then in the cold reduced to 5 mm. After cold rolling, samples were taken for this investigation. All the samples were subjected before testing to a heat treatment. The long-term hardness and creep rate were taken every 100 hours as criteria to evaluate the heat resistance. An increase in the mischmetal content to 0.1% leads to a considerable increase in the heat resistance of chromium bronze in the temperature range 0f 400 - 700 C, and, since in this case the stability of the alloys is determined by the dispersity of the chromium particles, the mischmetal changes the kinetics of their coalescence, the super-ageing of the alloy is retarded, and the heat resistance increases. Author

N72-16380 National Lending Library for Science and Technology, Boston Spa (England).
NEW SHAPES OF FERRITE SHELL TYPE CORES
M. Schlotterbeck and W. Schmidt 20 Sep. 1971 12 p refs Transl. into ENGLISH from Siemens-Bauteile-Inform. (West Germany), v. 8, 1970 p 118-122
(NLL-Trans-841-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Round shell-type cores and repeating coils are described. Their use is due to optimum facilitating application. These cores are satisfactory from the magnetic point of view, but are not from the points of view of packing density on the printed circuit board, and rationalization in the coils windings. A space saving and mechanically stable arrangement of pins on the coil former requires suitable dimensioning of the shell-type cores with larger apertures than in the round cores. This produced the X-cores introduced as repeating coil cores for medium and large coils. A further reduction of the X-cores is not possible because of too great a tendency to break, and difficulties in manufacture. Author

N72-16381 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF CREEP ON LOW CYCLE FATIGUE OF 18Cr-9Ni-Ti STEEL AT RAISED TEMPERATURES
E. A. Antipov 19 Nov. 1971 5 p Transl. into ENGLISH from Probl. Prochnosti (USSR), no. 4, 1970 p 40-44 In ENGLISH and RUSSIAN
(NLL-Trans-746-923-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A quantitative evaluation was made of creep effects on cycle fatigue of steel at 670 C. It is shown that plastic deformation increases under conditions of low cycle fatigue and creep with a decrease in the creep parameter gamma. The reverse is true under conditions of isothermal creep. K.P.D.

N72-16382 National Lending Library for Science and Technology, Boston Spa (England).
EFFECTS OF THE TEMPERATURE AT WHICH THE 50N AND 79NM PERMALLOY ALLOYS ARE ANNEALED ON THEIR TEXTURE AND MAGNETIC PROPERTIES
N. F. Dubrov and Yu. M. Gertman Dec. 1971 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 6, 1970 p 112-116
(NLL-RTS-6629) Avail: Natl. Lending Library, Boston Spa, Engl.: £10.80 or 3 NLL photocopy coupons

The changes in crystal structure and magnetic properties with respect to the degree of perfection of the initial structure, the reduction, and annealing temperature were studied. One alloy contained 49.8% Ni (50N), and the other contained 79.5% Ni and 4.3% Mo (79NM). Strips 3 mm thick were cold rolled with reductions of 98.5% (50N) and 97% (79NM). These were annealed for 2 hr at 850 C and then cold rolled to a final thickness of 0.05 mm (50N) and 0.1 (79NM). Bands 10 mm wide were coiled into 25 to 30 mm diameter toroids and annealed in a vacuum between 1000 and 1300 C. The crystalline structure and magnetostriction were determined, and the changes over the 1000 to 1300 C temperature range are discussed. N.E.N.

N72-16383 National Lending Library for Science and Technology, Boston Spa (England).
MICROSTRUCTURE AND SUPER PLASTICITY OF HIGH-CHROMIUM Cr-Ni-Fe ALLOYS
N. A. Karpov and E. D. Glebova 19 Nov. 1971 5 p ref Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 14, no. 2, 1971 p 105-108 In ENGLISH and RUSSIAN
(NLL-746-990-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The alloys were prepared from ferro-chrome mark FKh002, electrolytic nickel N-1, and iron in a 50-kilogram induction furnace, lined with fused magnesite. Hollow blanks, 162 x 55 mm in diameter and 310 mm in length, were cast on the centrifugal machine. From these blanks, after machining and boring to a diameter of 151 x 45 mm and heating to 1170 C in an argon atmosphere, tubes 83 x 12 mm in diameter were obtained by means of extrusion on a horizontal press 1600 at a rate of 60 mm/sec, which were then cooled in air. Author

N72-16384 National Lending Library for Science and Technology, Boston Spa (England).
CREEP STRENGTH AND STRUCTURE OF THE STEEL 10 Cr Mo910
A. Krisch 10 Nov. 1971 14 p Transl. into ENGLISH from Arch. Eisenhuettenw. (Duesseldorf), v. 41, Sep. 1970 p 835-840
(NLL-CE-Trans-5716-(9022.09)) Avail: Natl. Lending Library,

Boston Spa, Engl.: 2 NLL photocopy coupons

Nine heats with 0.1% C, 2.25% Cr, 1% Mo subjected to 15 different heat treatment processes yielded virtually the same sequence for the 1000 to 50,000-hours creep strength so that the choice of characteristic has no great significance for the assessment of these materials. The materials with the higher creep strength have a ferrite-pearlite or ferrite-bainite structure; the ferrite contains precipitations which are smaller by an order of magnitude than the carbides of pearlite and bainite. The materials with the lower creep strength, on the other hand, are completely transformed in the austempering region. Author

N72-16385 National Lending Library for Science and Technology, Boston Spa (England).

EFFECTS OF STRESS RAISES ON THE HIGH-TEMPERATURE STRENGTHS OF CERTAIN ALLOYS

A. A. Klypin and Yu. P. Frolov 1971 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 7, 1971 p 145-148

(NLL-M-21170-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The relationship of the sensitivity of certain high temperature alloys to stress-increasing factors was studied. Long duration strength was tested at high temperatures in relation to structural transformations taking place along grain boundaries and within grains. Methods of assessing the susceptibility of metals to such stress-increasing factors are considered. Service life of the Zh 98-KP alloy increases during stress if zones containing little of the intermetallic hardening phase are created at grain boundaries. It was shown that the E1437A alloy and the E1481 and Kh18N9T steels can be strengthened by aging under stress greater than the working stress. Author

N72-16386*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMOGRAVITY SYSTEM DESIGNED FOR USE IN DISPERSION STRENGTHENING STUDIES

Thomas P. Herbell [1972] 24 p refs Presented at North Am. Thermal Analysis Soc., Waco, Tex., 6-7 Feb. 1972

(NASA-TM-X-67999; E-6756) Avail: NTIS CSCL 11F

A thermogravimetry system designed to study the reduction of oxides in metal and alloy powders to be used in dispersion strengthened materials is described. The apparatus was devised for use at high temperatures with controlled atmospheres. Experimental weight change and moisture evolution results for the thermal decomposition of calcium oxalate monohydrate in dry helium, and experimental weight change results for the reduction of nickel oxide in dry hydrogen and hydrogen containing 15,000 PPM water vapor are presented. The system is currently being successfully applied to the evaluation of the reduction characteristics and the removal of impurities from metals and alloys to be used for dispersion strengthening. Author

N72-16387*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRETTING WEAR IN TITANIUM, MONEL-400, AND COBALT 25-PERCENT-MOLYBDENUM USING SCANNING ELECTRON MICROSCOPY

Robert C. Bill Washington Feb. 1972 35 p refs Prepared in cooperation with Army Air Mobility Res. and Develop. Lab., Cleveland, Ohio

(NASA-TN-D-6660; E-6623) Avail: NTIS CSCL 11F

Damage scar volume measurements taken from like metal fretting pairs combined with scanning electron microscopy observations showed that three sequentially operating mechanisms result in the fretting of titanium, Monel-400, and cobalt - 25-percent molybdenum. Initially, adhesion and plastic deformation of the surface played an important role. This was followed after a few hundred cycles by a fatigue mechanism which produced spall-like pits in the damage scar. Finally, a combination of oxidation and abrasion by debris particles became most significant. Damage scar measurements made on several elemental metals after 600,000 fretting cycles suggested that the ratio of oxide hardness to metal hardness was a measure of the susceptibility of a metal to progressive damage by fretting. Author

N72-16388*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CREEP-RUPTURE TESTS OF INTERNALLY PRESSURIZED RENE 41 TUBES

Klaus H. Gumto and Barry Weiss Washington Feb. 1972 22 p refs

(NASA-TM-X-2505; E-6648) Avail: NTIS CSCL 11F

Weld-drawn tubes of Rene 41 with 0.935 centimeter outside diameter and 0.064 centimeter wall thickness were tested to failure at temperatures from 1117 to 1233 K and internal helium pressures from 5.5 to 12.4 meganewtons per square meter. Lifetimes ranged from 5 to 2065 hours. The creep-rupture strength of the tubes was 50 percent lower than that of unwelded, thick sheet specimens, and 20 percent lower than that of unwelded, thin sheet specimens. Larson-Miller correlations and photomicrographs of some specimens are presented. Author

N72-16389# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

MICROHARDNESS PHENOMENA IN SILVER

C. C. Chen and A. A. Hendrickson Jun. 1971 36 p refs

(Contract AT(11-1)-916)

(COO-916-23) Avail: NTIS

Microhardness measurements show that the indentation characteristics have marked differences depending on both the load range applied and the crystal perfection. In the low-load range (0.02 to 2 grams), the indentation creep phenomenon at low temperatures was found in low dislocation density crystals. Measurements of indentation in the higher load range (5 to 25 grams) indicate no time dependence of hardness. The indentation hardness is found to be time insensitive for rather high dislocation density crystals. Studies of the shear zone configuration through dislocation etching revealed that in the low load region the shear zone is confined to the rosette pattern. On increasing the indentation load, the shear zone loses the rosette configuration. Thus, the time sensitive indentation hardness at low temperatures appears to be associated with rosette formation; no rosette configuration is observed for high dislocation density crystals. The low temperature indentation creep behavior appears to be a result of the dynamic behavior of the Frank-Read mechanism. Author

N72-16390# Purdue Univ., Lafayette, Ind.

MULTIPHASE DIFFUSION IN Cu-Ni-Z N SYSTEM

R. D. Jr. Sisson and M. A. Dayananda 1 Aug. 1971 28 p refs

(Contract AT(11-1)-1436)

(COO-1436-31) Avail: NTIS

Isothermal, multiphase diffusion was investigated with infinite diffusion couples in the Cu-Ni-Zn system at 775 C. The couples were assembled with disks a of beta (bcc) ternary alloy sandwiched between disks of selected binary, Cu-Ni alpha (fcc) alloys and were annealed for 2 hours to 2 days. The diffusion structures were investigated metallographically and by electron probe analysis. The couples developed multiphase structures that showed transitions from planar interfaces to nonplanar morphologies with changes in composition of the alpha terminal alloys. The various structures are described by the aid of composition paths. The velocity of planar interfaces is discussed in terms of intrinsic fluxes in the adjacent phases. Author

N72-16391# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

SWELLING IN REFRACTORY METALS DURING HIGH TEMPERATURE ION BOMBARDMENT

G. L. Kulcinski and J. L. Brimhall Jun. 1971 7 p refs Presented at Joint Meeting of Am. Nucl. Soc., Miami, Fla., 17 Oct. 1971

(Contract AT(45-1)-1830)
(BNWL-SA-3962; Conf-711009-3) Avail: NTIS

Voids were found in Mo, TZM, and Nb after 5-MeV Ni ion bombardment (to 5 displacements per atom) at 800, 900, and 1000 C, but not at 650 C. The void size and shape are discussed. Voids were also found in V after 7.5-MeV Ta ion bombardment at 700 and 800 C, but not at 900 C. NSA

N72-16392# Japan Atomic Energy Research Inst., Tokyo.
EFFECT OF ALPHA-RAY IRRADIATION ON CREEP RUPTURE PROPERTIES OF AUSTENITIC STAINLESS STEEL
Teruo Furuta, Yutaka Ogawa, and Ryukichi Nagasaki Apr. 1971 21 p refs In JAPANESE and ENGLISH
(JAERI-Memo-4408) Avail: AEC Depository Libraries

Mechanical properties of stainless steel are affected by neutron irradiation. Creep properties, of course, are largely reduced. It is deduced that this effect is principally caused by helium bubbles. It is important to study the effect of helium bubbles on the mechanical properties, especially creep-rupture, of stainless steel. Helium was injected into AISI Type 316 stainless steel using a cyclotron, then creep rupture tests at 750 C were carried out. As a result, the presence of helium caused large reductions in rupture life and strain-to-rupture. Observing fractured surfaces with light and the scanning electron microscope, the effects of contained helium were clearly shown.
Author (NSA)

N72-16393# Purdue Univ., Lafayette, Ind.
DIFFUSION IN TERNARY SILVER-ZINC-CADMIUM SOLID SOLUTIONS
P. T. Carlson, M. A. Dayananda, and R. E. Grace 14 Jun. 1971 41 p refs
(COO-1436-30) Avail: NTIS

Diffusion in the silver-zinc-cadmium system was investigated at 600 C with semi-infinite, vapor-solid couples in order to evaluate intrinsic diffusion coefficients and interdiffusion coefficients in the alpha and beta phases. Intrinsic diffusion coefficients were determined at several composition points in the alpha phase region along concentration lines of 11 at.% Zn, 18 at.% Zn, 5 at.% Cd and 9 at.% Cd. Interdiffusion coefficients in the alpha phase were determined at several points of intersection of various composition paths; these composition points of intersection were along lines of constant zinc-to-cadmium concentration ratios of 3.8, 1.8, and 1.2. All two-phase diffusion couples developed planar beta/alpha interfaces. Intrinsic coefficients were computed at three composition points in the beta region corresponding to a silver concentration of approximately 55 at.%. Intrinsic coefficients for beta alloys are two to three orders of magnitude larger than those for alpha alloys.
Author

N72-16394# Bendix Corp., Kansas City, Mo.
ELECTROPOLISHING CVD TUNGSTEN Interim Report
1971 31 p refs Presented at 4th Ann. Meeting of the Intern. Metallographic Soc., Denver, Colo., 21 Sep. 1971
(Contract AT(29-1)-613)
(BDX-613-242; Conf-710902-1) Avail: NTIS

A detailed study was made of using electropolishing to reveal various microstructures in chemical vapor deposited tungsten. The voltage-current relationship was established and a voltage range was found for revealing in the microstructure markings produced by plating parameter changes. Surface microtexture produced by the several polishing procedures was correlated with deposit hardness and transport conditions.
Author (NSA)

N72-16395# Oak Ridge National Lab., Tenn.
EFFECTS OF STRUCTURAL IMPERFECTIONS ON VOIDS IN ALUMINUM
K. Farrell, J. T. Houston, A. Wolfenden, R. T. King, and A. Jostsons Sep. 1971 20 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9-11 Jun. 1971
(Contract W-7405-Eng-26)
(ORNL-TM-3493) Avail: NTIS

Impurities, inclusions, dislocations, and grain boundaries are structural features that significantly influence the nature and distribution of voids in neutron irradiated aluminum. Preinjected hydrogen and helium are shown to increase the nucleation of voids for a given fluence without changing the swelling, whereas substitution-type impurities retard void nucleation. Accelerated void development is frequently noted in the immediate vicinity of inclusions, and in some cases large, spherical shells of voids from around inclusions. A microstructure consisting of many fine precipitates and dislocations has a much improved resistance to void formation.
Author (NSA)

N72-16396# Oak Ridge National Lab., Tenn.
VOID FORMATION IN NEUTRON IRRADIATED METALS
J. O. Stiegler Sep. 1971 60 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9-11 Jun. 1971
(Contract W-7405-Eng-26)
(ORNL-TM-3495; Conf-710601-13) Avail: NTIS

The characteristics of void formation in high purity metals are reviewed and summarized in terms of irradiation and material variables. Fluence, irradiation temperature, flux and spectral effects, and the role of impurities are discussed. Results are compared and contrasted with those for stainless steel and evaluated in terms of proposed mechanisms for the nucleation and growth of voids. Although general trends of behavior are established for most of the experimental variables, exceptions are invariably found. The observations indicate that details of the damage structure are purity- and structure-sensitive.
Author (NSA)

N72-16397# Oak Ridge National Lab., Tenn.
EFFECT OF ALLOYING AND PURITY ON THE FORMATION AND ORDERING OF VOIDS IN BCC METALS
F. W. Wiffen Sep. 1971 22 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9-11 Jun. 1971
(Contract W-7405-Eng-26)
(ORNL-TM-3496; Conf-710601-11) Avail: NTIS

The void populations in Mo, Nb, V, and one alloy of each of these were compared by electron microscopy. All three of the systems responded differently to the alloying. The void concentrations and sizes in the Mo and Mo-0.5% Ti irradiated at 790 C were identical within the measurement limits. After irradiation at 585 C the Mo-0.5% Ti contained more voids than the Mo, but the sizes were nearly identical. Alloying Nb with 1% Zr reduced the void concentration after irradiation at 790 C by more than an order of magnitude, but this was compensated by an increase in void size. High void concentrations were observed in V irradiated at 385 to 600 C, but samples of V-20% Ti irradiated in the range 475 to 600 C had no detectable voids.
Author (NSA)

N72-16398# Hanford Engineering Development Lab., Richland, Wash.
BIAXIAL STRESS RUPTURE PROPERTIES OF ANNEALED 316 STAINLESS STEEL AFTER EBR-2 IRRADIATION
R. W. Barker and J. J. Holmes Aug. 1971 22 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-72) Avail: NTIS

The effects of EBR-2 irradiation on the biaxial stress-rupture properties of mill-annealed Type 316 stainless steel were investigated at test temperatures of 1000, 1200 and 1400 F. Tubular cladding specimens having a 0.208 inch diameter and 0.008 inch wall were irradiated in Row 7 to a total fluence of 1.2 x 10 to the 22nd power newtons per square centimeter at an irradiation temperature of 1050 F plus or minus 100. The composition of the tubing was 0.081 C, 2.3 Mo, 1.5 Mn, 13.2 Ni, 17.0 Cr and 0.5 Si. EBR-2 irradiation produces a loss in rupture strength and ductility at all test temperatures and an

increase in average creep rate at 1000 F. Stress-to-rupture values were reduced by about a factor of one fortieth at a test temperature of 1000; at 1200 F a loss of about a factor one half occurred. At 1400 F, the reduction in strength was highly stress dependent, but reductions as great as a factor of one tenth were observed. Creep strain was reduced as much as a factor of one twenty-fifth depending on test temperature and test duration. The greatest losses in ductility occurred at 1000 and 1400 F, with less effect occurring at 1200 F. Author (NSA)

N72-16399# Atomic Weapons Research Establishment, Aldermaston (England).
PREFERENTIAL DEPOSITION OF THIN SILVER FILMS INDUCED BY ELECTRON BOMBARDMENT
P. T. Stroud Aug. 1971 12 p refs
(AWRE-O-42/71) Avail: AEC Depository Libraries

Deposition of silver on silica or freshly evaporated silicon monoxide is described. Electron bombardment induces the preferential deposition of silver on pure fused silica, but the reverse effect is noted with evaporated silicon monoxide. Attempts are made to explain these phenomena. Author (NSA)

N72-16400# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
SOME MECHANICAL PROPERTIES OF DTD 5025 MAGNESIUM ALLOY CASTINGS
R. T. Potter London Aeron. Res. Council 1971 65 p refs Supersedes RAE-TR-70124; ARC-32722
(ARC-CP-1160; RAE-TR-70124; ARC-32722) Avail: NTIS; HMSO: £0.85; PHI $3.55

An investigation into tensile and torsional properties of DTD 2025 magnesium alloy castings is described. Strength and stiffness values are given and the variation of these parameters between different batches and manufactures is shown. The effect on mechanical properties of long and short term temperature environments is indicated. ESRO

N72-16401# Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF CRACK PROPAGATION
M. F. Kanninen and P. C. Gehlen Oct. 1971 20 p refs Presented at the Battelle Colloq. on Interatomic Potentials and Simulation of Lattice Defects, Seattle-Harrison, Jun. 1971 Submitted for publication
(Contract N00014-70-C-0390)
(AD-731402; TR-13) Avail: NTIS CSCL 11/6

In previous attempts to simulate crack extension on a (100) plane in alpha iron, it was not possible to induce the rupture of atomic bonds at the crack tip. The work reported here overcomes this deficiency by considering the crack front to be jogged. It is then found that an existing crack will heal or will extend, depending on whether the stress intensity factor is less than or is greater than the critical value. The results are in quantitative agreement with the critical stress intensity factor determined indirectly in the previous work and are consistent with the Griffith criterion for quasi-brittle crack growth. Author (GRA)

N72-16402# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETICS OF STRESSES AND FAILURE OF HARDENING MATERIALS
V. V. Larinov 28 Jul. 1971 15 p refs Transl. into ENGLISH from publ. "Prochnost Pri Malom Chisle Tsiklov Nagruzheniya Voprosy Mekhanicheskoy Ustalosti" Moscow, Izd-vo Nauka, 1969 p 87-93
(Contract F33657-71-D-0057; AF Proj. 3066)
(AD-731907; FTD-HC-23-688-71) Avail: NTIS CSCL 11/6

An investigation is given of the stressed state and time failure of an aluminum alloy and a brand of steel capable of cyclic hardening. An automatic electronic device is used for plotting the cyclic deformation diagrams of these materials under tensile and compression loads up to 5 tons. Fatigue curves are plotted for specimens under soft and hard loading. The variations in the stress-strain state of machine parts made of these materials are found to depend on the distribution of plastic deformation. Author (GRA)

N72-16403# Southwest Research Inst., San Antonio, Tex. Dept. of Structural Research.
THE EFFECT OF RESIDUAL STRESS ON CRACK PROPAGATION IN HY-80 STEELS
Robert Sherman 22 Oct. 1971 22 p ref
(Contract N00014-70-C-0265; SwRi Proj. 03-2801)
(AD-732028) Avail: NTIS CSCL 11/6

Tests were conducted to determine the effect of residual stress on the rate of crack growth in HY-80 plate steel. A residual stress field, over and above that inherently present in as-quenched and tempered material, was induced by means of welding-in of a pre-cracked patch plate into the specimen body; a cyclic load, which would induce particular values of stress intensity, was then applied. From the ensuing test results, a growth rate relation was determined and compared to a similar relation obtained from like tests performed on specimens having zero weld-induced residual stress. Author (GRA)

N72-16404# Army Materials and Mechanics Research Center, Watertown, Mass.
DETERMINATION OF LOW COPPER IN STEELS AND IRONS BY ATOMIC ABSORPTION Product Technical Report
Edna F. Jacobson Aug. 1971 20 p refs
(PEMA Proj. 4931)
(AD-731478; AMMRC-PTR-71-2) Avail: NTIS CSCL 11/6

An analytical method has been developed for the rapid determination of low copper (50 to 1800 parts per million) by atomic absorption. The method was successfully applied to different types of steels and irons, for example, low-alloy steel, stainless steel, tool steel, maraging steel, ingot iron, and cast iron. The detailed analytical method is appended to this technical report. Author (GRA)

N72-16405# Naval Civil Engineering Lab., Port Hueneme, Calif.
CORROSION OF MATERIALS IN HYDROSPACE. PART 4: STAINLESS STEELS Technical Note, 1962-1969
Fred M. Reinhart Sep. 1971 111 p refs
(YF Proj. 38-535-005-01-004)
(AD-732365; NCEL-TN-1172) Avail: NTIS CSCL 11/6

A total of 1,750 specimens of 57 different stainless steels were exposed in seawater at the surface and at depths of 2,500 and 6,000 feet in the Pacific Ocean for periods of time varying from 123 to 1,064 days in order to determine the effects of the seawater environments at different depths on their corrosion resistance. Corrosion rates, type of corrosion, pit depths and stress corrosion cracking resistance are presented. In general, corrosion in surface seawater was more severe than in the deep seawater and in the bottom sediments at depths of 2,500 and 6,000 feet for equivalent periods of exposure. Author (GRA)

N72-16406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF PEAK LOADS ON THE FATIGUE STRENGTH OF STEELS UNDER CHANGING LOAD CONDITIONS
L. V. Konovalov, N. N. Nistratov, L. T. Timoshuk, and A. P. Kulikov 25 Aug. 1971 13 p refs Transl. into ENGLISH from Sb. Tr. Nauch.-Issled. Inst, Cherno, Met. (USSR), no. 73, 1969 p 61-66
(AF Proj. 7343)
(AD-731925; FTD-HT-23-1045-71) Avail: NTIS CSCL 11/6

The influence of peak loads on the cyclical durability of steels under changing load conditions close to actual load conditions of machine parts was researched. Author (GRA)

N72-16407# Army Materials and Mechanics Research Center, Watertown, Mass.
TWINNING AND TEXTURE TRANSITIONS IN TITANIUM

SOLID-SOLUTION ALLOYS
Frank R. Larson, Anthone Zarkades, and D. H. Avery Jun. 1971 129 p refs
(DA Proj. 1T0-62105-A-328)
(AD-731791; AMMRC-TR-71-11; AMCMS-Code-502E.11.294; DA-OA4716) Avail: NTIS CSCL 11/6

The preferred orientation of cold-rolled sheet processed from laboratory heats of several titanium binary alloy series was studied. Titanium-based alloys of iron, manganese, chromium, cobalt, nickel, copper, molybdenum, vanadium, columbium, aluminum, tin, and zirconium were included in the investigation. It was found that additions of beta stabilizers caused a texture transition when the retained beta was in excess of about 16 volume percent. This texture transition, for the basal pole, may be roughly described as an unalloyed titanium to zinc-type transition. Copper was an exception and alloys of this element had a tendency to form an 'ideal' (0001) (10-10) type texture similar to that previously found for additions of the alpha stabilizer aluminum. Neutral alloying elements like tine and zirconium were found to have only a small effect upon the texture, merely sharpening the unalloyed type. Little effect of lattice parameters was noticed except for a trend of high c/a ratio alloys to produce a component of a stable end orientation of the (11-20)(10-10) type. A qualitative discussion of how these textures form is included; however, due to a lack of complete information about roll-gap stresses and deformation, along with absence of values for critical stresses for slip and twinning in these alloys, it was not possible to be quantitative.
Author (GRA)

N72-16408# Aluminum Co. of America, New Kensington, Pa. Alcoa Research Labs.
STUDY TO DEVELOP HOMOGENEOUS ALUMINUM ALLOY MATERIAL SUITABLE FOR CARTRIDGE CASE MANUFACTURE Final Report, 25 Feb. 1970 - 12 Jul. 1971
Ralph W. Rogers, Jr. and Barris S. Shabel 12 Jul. 1971 80 p refs
(Contract DAAA25-70-C-0442)
(AD-731877; Rept-13-AX209) Avail: NTIS CSCL 11/6

Fourteen alloy compositions employing refined 99.99% aluminum as the base metal were fabricated into .063 inch sheet by procedures which resulted in less than 0.2 volume percent second-phase constituent particles in 11 of the 14 compositions. Strength-toughness characteristics of two variations of the Al-5.9 Zn-2.3 Cu-2.2 Mg basic alloy closely approached cartridge case alloy goals. Although of equal homogeneity, sheet of 2XXX, 6XXX and Cu-free 7XXX alloys had either significantly lower strength or toughness than that of the Al-Zn-Cu-Mg alloys. Strength-toughness characteristics of the Al-Zn-Cu-Mg alloys were related to the mode of fracture as well as to homogeneity. Electron microscopy revealed no structural differences related to mode of fracture or toughness parameter other than those resulting from precipitation treatment differences which affected the mode of fracture significantly. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-16409*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONFERENCE ON MATERIALS FOR IMPROVED FIRE SAFETY
Washington 1971 209 p refs Conf. held in Houston, Tex., 6-7 May 1970
(NASA-SP-5096; LC-79-611768) Avail: NTIS; SOD $2.25 CSCL 13L

The proceedings of a conference on materials for improved fire safety are presented. The application of fireproof material for spacecraft design and development of supporting equipment is discussed. Fire resistant materials for use as space suits and protective clothing are examined. Tests to determine fire resistance of selected materials are described. For individual titles, see N72-16410 through N72-16436.

N72-16410*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE COMBUSTION PROCESS **c33**
W. R. Downs *In its* Conf. on Mater. for Improved Fire Safety 1971 p 3-7 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

The effect of thermodynamic, chemical, and physical properties on the combustion of materials is discussed. The mechanisms which produce and support combustion of various materials are examined. The effects of free radical reactions, convection and gravitational effects on combustion rates, and changes in flame propagation due to size and shape of surfaces are described. Author

N72-16411*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SPACECRAFT NONMETALLIC-MATERIALS FLAMMABILITY SELECTION CRITERIA AND REQUIREMENTS **c33**
C. J. Katsikas and J. H. Levine *In its* Conf. on Mater. for Improved Fire Safety 1971 p 9-21 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

The criteria and requirements governing the selection and use of nonmetallic materials in manned spacecraft to control potential fire hazards are reviewed. The development of flammability requirements is discussed and traced through the historical evolution. Events that dictated the changes that have taken place are discussed. The current nonmetallic material requirements are presented. Significant features of a nonmetallic materials handbook are included. Author

N72-16412*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT OF MATERIALS SCREENING TESTS FOR OXYGEN-ENRICHED ENVIRONMENTS **c33**
R. L. Johnston and D. L. Pippen *In its* Conf. on Mater. for Improved Fire Safety 1971 p 23-27 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

The criteria governing materials to be used in an oxygen enriched atmosphere and tests to determine suitability for fireproof considerations in spacecraft design are discussed. The nine tests applied to materials before acceptance in spacecraft construction are presented. The application of the standard tests to determine ranking of materials is included. Author

N72-16413*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY TESTING OF COMPONENTS
Gary R. Primeaux *In its* Conf. on Mater. for Improved Fire Safety 1971 p 29-42 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11C

Flammability testing of components in the design of Apollo spacecraft is discussed. The purpose of component flammability testing was to determine the flammability characteristics of a variety of different sizes, shapes, and configurations of nonmetallic materials of similar or different types that make up a functional assembly, subsystem, or system in a spacecraft. The test criteria and requirements for the nonmetallic materials are presented.
Author

N72-16414*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY TESTS FOR APOLLO COMMAND MODULE AND LUNAR MODULE MOCKUP **c33**
R. W. Bricker, J. P. Crabb, and I. K. Spiker *In its* Conf. on Mater. for Improved Fire Safety 1971 p 43-54 ref (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

The flammability test program for Apollo command module and lunar module mockups is described. The fire safety design of the modules was verified by performing deliberate ignitions at many locations while the interior atmosphere was controlled to simulate realistic flight conditions. The data obtained for each test and restrictions on various materials are discussed. Author

N72-16415*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NONMETALLIC-MATERIALS DEVELOPMENT FOR SPACECRAFT APPLICATIONS
Frederick S. Dawn *In its* Conf. on Mater. for Improved Fire Safety 1971 p 57-63 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11C

The development, characteristics, and applications of nonmetallic materials used for spacecraft structures are discussed. The effects of extremes in environment as a factor in material selection are considered. Material design parameters are especially complex because of the requirements imposed for additional fire safety and resistance to the free space and lunar surface environment. Author

N72-16416*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT AND APPLICATIONS OF FLUOREL
Daniel E. Supkis *In its* Conf. on Mater. for Improved Fire Safety 1971 p 65-71 ref (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The development of a nonflammable elastomer for use in Apollo spacecraft is discussed. The requirements for the material to be foamed, extruded, compression molded, and cast into various configurations are examined. A fluorine-based hydrocarbon is considered a promising candidate. An acceptable material known as Fluorel is examined. Procedures for applying fluorel to a flood light glare shield are presented. The process for preparing 20 percent homogenized Fluorel is analyzed. Author.

N72-16417*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT AND APPLICATION OF FLAME-RESISTANT POLYMERS AND COMPOSITES
Dale G. Sauers *In its* Conf. on Mater. for Improved Fire Safety 1971 p 73-82 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The development and characteristics of flame resistant polymers and composite materials for use in spacecraft structures are discussed. The requirement for the material to be nonflammable in the oxygen enriched atmosphere of the spacecraft is examined. The properties of various materials are tabulated and compared. Specific applications of various materials are presented. Author

N72-16418*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT OF NONFLAMMABLE POTTING COMPOUNDS FOR SPACECRAFT
Harry F. Kline *In its* Conf. on Mater. for Improved Fire Safety 1971 p 83-90 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The requirements for nonflammable potting compounds for use in spacecraft electric and electronic equipment are discussed. The development of a suitable nonflammable compound is described. Flammability testing and acceptance criteria for Apollo spacecraft are presented. The dielectric properties of various ceramic materials used as conformal coatings are examined. Author

N72-16419*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NEW MATERIALS FOR MANNED SPACECRAFT, AIRCRAFT, AND OTHER APPLICATIONS
Matthew I. Radnofsky *In its* Conf. on Mater. for Improved Fire Safety 1971 p 91-102 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The application of fire resistant spacecraft materials to the interior design of commercial aircraft is discussed. The use of such materials for curtains, upholstery, carpets, decorative panels, cabinets, paper products, and oxygen lines is examined. It is concluded that the highest degree of nonflammability can be obtained with inorganic fibers such as asbestos and fiber glass. The application of various chemical compounds for specific purposes is presented. Author

N72-16420*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE PERFORMANCE OF LIGHTWEIGHT PLASTIC FOAMS DEVELOPED FOR FIRE SAFETY
Richard H. Fish *In its* Conf. on Mater. for Improved Fire Safety 1971 p 103-110 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The use of a low density, polyurethane based foam to suppress a fire and to provide protection for the structure of an aircraft or spacecraft is discussed. The mechanism by which foams provide protection from heat and create a nonflammable surface is described. Various materials and their application to specific types of structures are examined. Author

N72-16421*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INTUMESCENCE: AN IN SITU APPROACH TO THERMAL PROTECTION
G. M. Fohlen, J. A. Parker, S. R. Riccitiello, and P. M. Sawko *In its* Conf. on Mater. for Improved Fire Safety 1971 p 111-119 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The thermal protection of flammable structures with intumescent protective coatings is discussed. Various materials which have demonstrated an ability to provide protection through intumecence are described. Materials tests for intumescent coatings are presented and physical properties of various materials are included. Author

N72-16422*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
NONMETALLIC-MATERIAL CONFIGURATION CONTROL IN THE APOLLO SPACECRAFT
M. W. Steinthal *In its* Conf. on Mater. for Improved Fire Safety 1971 p 123-128 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The methods employed by NASA to establish configuration control of nonmetallic materials on Apollo spacecraft are described. A five step procedure for examining contractor materials for suitability and compatibility is presented. The compatibility of the materials with the oxygen enriched environment of the spacecraft enclosures is emphasized. Author

N72-16423*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO SPACECRAFT NONMETALLIC MATERIALS APPLICATIONS
Jerry W. Craig *In its* Conf. on Mater. for Improved Fire Safety 1971 p 129-135 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The applications of nonmetallic materials to the structures of Apollo spacecraft are discussed. The spacecraft components

are examined and the rationale behind the use of specific nonmetallic materials is presented. The emphasis is on the compatibility of the materials with the oxygen enriched atmosphere of the spacecraft enclosures. Author

N72-16424*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE EFFECTS OF GRAVITY ON FLAMMABILITY c33
James P. Pearce, J. Howard Kimzey, and David L. Pippen *In its* Conf. on Mater. for Improved Fire Safety 1971 p 137 refs This rept. was not presented at the conf. (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

The effects of weightlessness and increased gravity on flammability and flame propagation are discussed. The test equipment and procedures for determining gravity effects are described. Comparisons are made between flammability under normal gravity conditions and occurrences under altered gravity conditions Author

N72-16425*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO APPLICATIONS OF BETA FIBER GLASS
Jack Naimer *In its* Conf. on Mater. for Improved Fire Safety 1971 p 141-144 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The physical characteristics of Beta fiber glass are discussed. The application of Beta fiber glass for fireproofing the interior of spacecraft compartments is described. Tests to determine the flammability of Beta fiber glass are presented. The application of Beta fiber glass for commercial purposes is examined. Author

N72-16426*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO SPACE-SUIT MATERIALS c05
Frederick S. Dawn and Ralph L. Jarboe *In its* Conf. on Mater. for Improved Fire Safety 1971 p 145-149 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06Q

The design, construction, and materials used in the Apollo space suit are discussed. The various materials and combinations of materials to obtain the desired type of protection are identified. Detailed descriptions are provided of the pressure garment, liquid cooled garment, extravehicular gloves, helmet, and boots. Author

N72-16427*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FIRE SAFETY DESIGN OF A MOBILE QUARANTINE FACILITY c11
Roderick S. Bass and John K. Hirasaki *In its* Conf. on Mater. for Improved Fire Safety 1971 p 151-154 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 14B

During the design phase of the Mobile Quarantine Facility (MQF), a primary consideration was fire safety. Therefore, appropriate criteria and ground rules were used in the design and construction of the facility. The fire codes and fire-requirement listings that are used by commerical airlines were supplied to the Manned Spacecraft Center (MSC) by the Federal Aviation Agency (FAA). After these codes were reviewed, a basic ground rule was adopted that flame protection for all combustible materials should be at least equivalent to or better than the standards for commercial aircraft. Because the MQF was designed to operate with an interior atmosphere of air rather than with an oxygen-enriched atmosphere such as that of the Apollo spacecraft cabin, the requirements for MQF material were not as stringent as those for the spacecraft. Author

N72-16428*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
FIRE AND SAFETY MATERIALS UTILIZATION AT THE JOHN F. KENNEDY SPACE CENTER
Joel R. Reynolds *In its* Conf. on Mater. for Improved Fire Safety 1971 p 155-161 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The special needs of the Kennedy Space Center in the area of protective garments for personnel engaged in hazardous emergency operations are discussed. The materials used in the protective clothing and the specialized applications of various materials are described. It is concluded that Nomex is the best general purpose nonflammable material for protective clothing. Author

N72-16429*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FIR EXTINGUISHMENT IN HYPOBARIC AND HYPERBARIC ENVIRONMENTS c33
J. Howard Kimzey *In its* Conf. on Mater. for Improved Fire Safety 1971 p 163-169 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

Work that has been performed to provide information on the effects of various fire extinguishing agents in special atmospheres is discussed. Data used in the development of both equipment and techniques for manned spacecraft and related equipment are discussed. The equipment includes a hypobaric chamber suitable for low pressure use and a hyperbaric chamber for high pressure operation. The effectiveness of agents in weightless environment is also discussed. Author

N72-16430*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SPACECRAFT ELECTRICAL FIRE SAFETY c31
Anthony W. Wardell *In its* Conf. on Mater. for Improved Fire Safety 1971 p 173-178 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 22B

The fire hazards created in spacecraft compartments by malfunction of electrical wiring are described. The tests for electrical wire/cable current overload flammability are presented. The application of electrical and material technologies to the reduction of fire hazards in spacecraft are examined. Author

N72-16431*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPECIAL FLAMMABILITY TEST TECHNIQUES
Dale G. Sauers *In its* Conf. on Mater. for Improved Fire Safety 1971 p 179-185 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The tests performed to determine the flammability of materials used in spacecraft structures are described. The purposes of the tests and the expected results are examined. The effects of various atmospheres on flammability are discussed. The test equipment used in conducting various tests are illustrated and explained. Author

N72-16432*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPECIALIZED TESTING AND EVALUATION OF SPACE-SUIT MATERIALS c05
Thomas J. Ballentine *In its* Conf. on Mater. for Improved Fire Safety 1971 p 187-190 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06Q

The selection of nonmetallic materials used in the Apollo space suits is discussed. The specialized test program to determine the flammability of selected space suit materials is described. Emphasis is placed on the equipment used to test and qualify the space suit materials and subassemblies for operation in the deep space environment. Author

N72-16433*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT OF AN OXYGEN IMPACT-TESTING METHOD

Herschel H. Jamison *In its* Conf. on Mater. for Improved Fire Safety 1971 p 191-202 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 11D

The development of a gaseous oxygen impact test method to aid in the selection of materials for high pressure oxygen systems is discussed. The objectives of the tests and the test equipment used are described. It is concluded that the impact test procedures are adequate for present purposes, but cannot be depended upon for establishing future standards. Author

N72-16434*# MSC White Sands Test Facility, N.Mex.
ODOR TEST **c05**
L. A. Schluter and D. L. Pippen *In its* Conf. on Mater. for Improved Fire Safety 1971 p 203-205 ref (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06K

To prevent the use of spacecraft material that would outgas objectionable or nauseating odors, an odor test was developed. This test provided a means whereby candidate spacecraft materials were subjected to a particular environment and the outgassed products were evaluated by an odor panel. This panel was comprised of individuals with acute olfactory senses. The test results of the odor panel provided design engineers with data regarding potential material-odor problems. The odor-test procedure, panel-member selection, and odor scoring methods are described and typical test results are presented. Author

N72-16435*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TOXICOLOGY OF SPACECRAFT MATERIALS **c04**
Elliott S. Harris *In its* Conf. on Mater. for Improved Fire Safety 1971 p 207-210 (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 06T

The procedures for determining the toxicity of products outgassed from spacecraft structures are discussed. The test equipment involved in the tests and the criteria for acceptability are described. The use of animals as the final step in determining toxicity of a spacecraft environment is explained. Author

N72-16436*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY CONTROL IN THE OXYGEN ENVIRONMENT OF THE APOLLO GUIDANCE AND NAVIGATION EQUIPMENT **c31**
Max D. Holley and Stanley Bachman *In its* Conf. on Mater. for Improved Fire Safety 1971 p 211-217 ref This rept. was not presented at the conf. (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 22B

The Apollo guidance and navigation (G&N) equipment test program, the redesign philosophy, and the actual equipment modifications that were used to limit burn rates in an environment of 100 percent oxygen at pressures of 6.2 and 16 psia are described. The major approach was a serious basic review of the real function of the nonmetallic materials of concern. The result of this review was that the materials could be replaced, eliminated, or covered by nonflammable metallic materials. Although several low-flammability nonmetallic materials were investigated, the direct approach of cover, eliminate, or replace generally proved to be quicker and more effective. Author

N72-16437*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
IMPACT SENSITIVITY OF MATERIALS IN CONTACT WITH LIQUID AND GASEOUS OXYGEN AT HIGH PRESSURE
R. J. Schwinghamer 4 Jan. 1972 24 p refs
(NASA-TM-X-64634) Avail: NTIS CSCL 11D

As a result of the Apollo 13 incident, increased emphasis is being placed on materials compatibility in a high pressure GOX environment. It is known that in addition to impact sensitivity of materials, approximately adiabatic compression conditions can contrive to induce materials reactivity. Test runs at high pressure using the ABMA tester indicate the following: (1) The materials used in the tests showed an inverse relationship between thickness and impact sensitivity. (2) Several materials tested exhibited greater impact sensitivity in GOX than in LOX. (3) The impact sensitivity of the materials tested in GOX, at the pressures tested, showed enhanced impact sensitivity with higher pressure. (4) The rank ordering of the materials tested in LOX up to 1000 psia is the same as the rank ordering resulting from tests in LOX at 14.7 psia. Author

N72-16438# Royal Aircraft Establishment, Farnborough (England).
STRENGTH PROPERTIES OF BONDED JOINTS OF CARBON FIBRE REINFORCED COMPOSITES
W. Althof Sep. 1971 32 p refs Transl. into ENGLISH of "Festigkeitsverhalten von Klebverbindungen aus Kohlenstoff-faserverstaerkten Kunstoffen (KFK)", Deutsche Luft- und Raumfahrt, West Germany, report DLR-FR-71-3)
(RAE-Lib-Trans-1616; BR-27619; DLR-FB-71-31) Avail: NTIS

Adherends of carbon fiber reinforced composites were bonded to each other and to aluminum, steel and titanium. The strength properties of these joints were investigated using aircraft structural adhesives. The test results showed relations between joint strength, adhesive ductility, and the interlaminar strength of the composite. Author

N72-16439*# Solar, San Diego, Calif.
ALLOYED COATINGS FOR DISPERSION STRENGTHENED ALLOYS
F. R. Wermuth and A. R. Stetson Oct. 1971 98 p refs
(Contract NAS3-14312)
(NASA-CR-120852; RDR-1686-3) Avail: NTIS CSCL 11D

Processing techniques were developed for applying several diffusion barriers to TD-Ni and TD-NiCr. Barrier coated specimens of both substrates were clad with Ni-Cr-Al and Fe-Cr-Al alloys and diffusion annealed in argon. Measurement of the aluminum distribution after annealing showed that, of the readily applicable diffusion barriers, a slurry applied tungsten barrier most effectively inhibited the diffusion of aluminum from the Ni-Cr-Al clad into the TD-alloy substrates. No barrier effectively limited interdiffusion of the Fe-Cr-Al clad with the substrates. A duplex process was then developed for applying Ni-Cr-Al coating compositions to the tungsten barrier coated substrates. A Ni-(16 to 32)Cr-3Si modifier was applied by slurry spraying and firing in vacuum, and was then aluminized by a fusion slurry process. Cyclic oxidation tests at 2300 F resulted in early coating failure due to inadequate edge coverage and areas of coating porosity. EMP analysis showed that oxidation had consumed 70 to 80 percent of the aluminum in the coating in less than 50 hours. Author

N72-16440# United Kingdom Atomic Energy Authority, Harwell (England).
METAL FIBER REINFORCED CERAMICS (A REVIEW)
Yu. E. Busalov and I. M. Kopev Jun. 1970 22 p refs Transl. into ENGLISH from Fiz. Khim. Orab. Mater. (USSR), no. 1, 1970 p 57-69
(LB/G-3074) Avail: AEC Depository Libraries

Data on ceramic-metal fiber composites are presented which show that it is possible, in principle, to fabricate quality ceramic metal fiber composite systems. Continuous fibers, meshes or ribbons are the most suitable forms of reinforcing elements. The maximum fiber volume fraction which contributes to an effective increase in the mechanical properties is 30 to 40%. Reinforcement significantly improves the mechanical properties of the materials, particularly the impact strength and thermal shock resistance. Composites based on pure AL2O3, SiO2, SiC, mullite, and mixtures of mullite and AL2O3 reinforced with molybdenum and niobium are the most promising.
Author (NSA)

N72-16441# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
THERMAL ANNEALING OF NEUTRON-IRRADIATED

CARBON. DEVELOPMENT OF ELECTRONIC PROPERTIES
A. Pacault (Domaine Univ.), A. Marchand (Domaine Univ.), J. Amiell (Domaine Univ.), E. Dupart (Domaine Univ.), J. Rappeneau, G. Micaud, and R. Wlodarsky 1970 24 p refs In FRENCH; ENGLISH Summary Presented at the 10th Biennial Conf. on Carbon, Bethlehem, Pa., Jun. 1971
(CEA-CONF-1823; Conf-710612-3) Avail: AEC Depository Libraries

Results of a study on the electronic properties of carbons after neutron irradiation are presented. The carbon specimens were thermally annealed and the resulting variation in their electronic properties (electrical resistivity, Hall effect, magneto-resistivity, magnetic susceptibility) were determined. Similar behavior found in oriented graphite and nuclear graphite have been observed. The pyrocarbon, which is damaged the most, recovers its initial properties with the most difficulty; however, the damage does not affect the eventual behavior during graphitization. Author (NSA)

N72-16442# Atomic Weapons Research Establishment, Aldermaston (England).
FIBRE REINFORCED MATERIALS. A PRELIMINARY SURVEY OF DESIGN ASPECTS
J. L. Dunbar Dec. 1970 125 p refs
(AWRE-O-77/70; UDC-661.8-494) Avail: AEC Depository Libraries; UK 85 p

The design aspects of fiber reinforced composites were studied. Topics discussed include: types of reinforcement, general theory of reinforcement, general theory of simple composites, composites containing discontinuous fibers, resin matrices, ceramic matrices, orientation of fibers, compressive strength, fracture and failure mechanism, and composite properties. F.O.S.

N72-16443# Bendix Corp., Kansas City, Mo.
DISTORTION ENERGY FAILURE THEORY FOR ORTHOTROPIC MATERIALS
G. W. Forman Jun. 1970 16 p refs
(BDX-613-136) Avail: NTIS

The failure integrity of orthotropic materials exposed to three dimensional stresses is analyzed. It was assumed that distortion energy poses a rational basis of predicting inelastic action of an orthotropic material exposed to principle stresses coincident with the material axes. An algebraic method was used in the analysis. E.H.W.

N72-16444# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.
THERMALLY INDUCED STRESSES IN FIBRE COMPOSITE MATERIALS
D. H. Ferriss Sep. 1971 30 p refs
(NPL-NAC-7) Avail: NTIS

Shear-lag methods are used to calculate the thermal stress distribution in the neighborhood of a broken fiber or near the end of a fiber in electric composites reinforced by two- and three-dimensional arrays of parallel fibers. The two forms of composite imperfections correspond to the weak and strong fiber interface cases. Exact mathematical formulation of the problems results in complex three-dimensional boundary value problems. In order to facilitate the solution physical and geometrical simplifications are introduced. The effect of further fiber breakage on the thermal stress in the neighborhood of a broken fiber is investigated for a two-dimensional composite. ESRO

N72-16445# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
PROPAGATION OF ELASTIC WAVES IN PERIODIC FIBER COMPOSITE MATERIALS
Tiao-Ming Wu and F. C. Moon May 1971 198 p refs Sponsored in part by NSF
(Contract DAHC04-69-C-0062; DA Proj. 2O0-61102-B-32-D)
(AD-731833; TR-27; AROD-8090-5-E) Avail: NTIS CSCL 11/4

Dynamic behavior of elastic waves propagating in periodic fiber composite materials has been investigated. The only case considered is when the elastic waves are propagating normally to the filaments. Two methods have been used, one being the method of Galerkin and the other one being the method of micromechanics. The tendency of the dispersion curves (group velocity vs. frequency) obtained by using these two methods has been confirmed by the experiment. Author (GRA)

N72-16446# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
CREEP OF A UNIAXIAL METAL MATRIX COMPOSITE SUBJECTED TO AXIAL AND NORMAL LATERAL LOADS
T. R. Branca Jun. 1971 64 p refs
(Contracts N00019-71-C-0323; N00019-70-C-0231; Grant NSF GK-13613)
(AD-731989; UILU-ENG-71-6005; T/AM-341) Avail: NTIS CSCL 11/4

The study presents a micromechanical solution for creep of a uniaxial, continuously reinforced, metal matrix composite. The composite is subjected to constant axial and normal lateral loads at constant temperature. Author (GRA)

N72-16447# Illinois Univ., Urbana.
TENSILE STRENGTH OF OFF-AXIS UNIDIRECTIONAL COMPOSITES
Kristina Lauraitis Aug. 1971 41 p refs
(Contract N00019-71-C-0323)
(AD-731990; UILU-ENG-71-6008; T/AM-344) Avail: NTIS CSCL 11/4

This investigation was designed to relate the strength of the lamina, or rectangular plate elements, considered to be dependent on voids, viewed here as tiny cracks, to the fracture toughness of the material. A linear elastic fracture mechanics analysis was used which focuses attention on the region surrounding the crack tip. The fracture strength of the composite is described in terms of the applied stress, the crack length, and stress intensities in the crack tip region. Author (GRA)

N72-16448# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
FAILURE MODES AND STRENGTH OF ANGLE PLY LAMINATES
Kristina Lauraitis Aug. 1971 75 p refs
(Contract N00019-71-C-0323)
(AD-731991; UILU-ENG-71-6009) Avail: NTIS CSCL 11/4

Balanced symmetric and non-symmetric angle-ply specimens were tested in simple tension to failure and a microscopic investigation of the fracture surfaces was conducted. On the basis of data and observations, the presence of two modes of failure is suggested and a fracture criterion proposed. For small angles with respect to the loading direction failure of brittle, balanced, symmetric, angle-ply laminates is due primarily to rapid crack extension from crack-like delaminations between plies. For higher angle orientations, crack extension proceeds along the fibers originating at voids normal to the plane of the lamina. Author (GRA)

N72-16449# Solar, San Diego, Calif.
EFFECT OF INTERFACES IN METAL MATRIX COMPOSITES ON MECHANICAL PROPERTIES Interim Technical Report, 1 Aug. 1970 - 1 Aug. 1971
Mark J. Klein and Arthur G. Metcalfe Oct. 1971 110 p refs
(Contract F33615-70-C-1814; Task-735306)
(AD-731829; RDR-1701-1; AFML-TR-71-189) Avail: NTIS CSCL 11/4

The effect of interface condition on the longitudinal and transverse strength of 6061 Al/B composites was investigated. The interface condition was varied by heat treatments at 940 to 1100F for times up to 192 hours, and was characterized by metallography, scanning electron microscopy, and electron microscopy of extracted interface material. Composites with 25

and 48 percent boron filaments were studied with fully annealed and with age-hardened matrices. Some studies were made of the effect of the interface on fracture toughness. Author (GRA)

N72-16450# Martin Marietta Corp., Orlando, Fla.
THERMOPHYSICOCHEMICAL COMPATIBILITY BETWEEN METAL CARBIDES AND METAL MATRICES Final Technical Report, 1 May 1969 - 1 May 1971
Branimir Botic, William R. Spencer, and William F. Stuhrke
Wright-Patterson AFB, Ohio AFML Jul. 1971 114 p refs
(Contract F33615-69-C-1637; Task-735306)
(AD-731815; OR-11225; AFML-TR-71-134) Avail: NTIS CSCL 11/3

A method of fabricating carbide-metal interaction specimens was developed and is described. The diffusion bonded specimens were employed in the experimental evaluation of the compatibility of MC type carbides in high temperature metal matrices. This was accomplished in an effort to evaluate the stability of the MC type carbide in terms of its potential use as a diffusion barrier in a carbon filament reinforced high temperature metal matrix composite system. Six MC type carbides were chosen based on structural and thermodynamics consideration. These carbides were: TiC, VC, HfC, TaC, NbC, and ZrC and were evaluated in pure Ni, pure Co, Ni-20Cr, Co-19.5Cr, IN 100, and MAR-M-509. The diffusion couples were evaluated after 25 hours at temperatures from 1000 to 1200C. Author (GRA)

N72-16451# Polytechnic Inst. of Brooklyn, N.Y.
EXPERIMENTAL INVESTIGATION OF THE FAILURE MECHANISMS OF FIBER REINFORCED COMPOSITES SUBJECTED TO UNIAXIAL TENSION Final Report, Feb. 1970 - Apr. 1971
A. F. Armenakas and C. A. Sciammarella Aug. 1971 68 p refs
(Contract F33615-70-C-1073; AF Proj. 7351)
(AD-731832; AFML-TR-71-179) Avail: NTIS CSCL 11/4

In the investigation, the distribution of the axial component of displacement in the plane of thin, unilayer, fiber-reinforced composite plates subjected to quasi-statically increasing tension (from zero to failure) in the direction of the fibers is established experimentally. The experimental results are used to (a) evaluate the strain distribution throughout the surface of the specimens during the process of loading; (b) establish the strain concentration in the neighborhood of broken fibers; (c) estimate the distribution of the normal component of strain in the fibers; (d) establish the ineffective length of broken fibers and the stress concentration in neighboring fibers as functions of the applied load. The experimental results are compared with those obtained on the basis of a theoretical analysis for establishing the distribution of stress in unilayer fiber reinforced plates, subjected to uniaxial tension in the direction of the fibers. The experimental results present new insight on the influence of the ineffective length of broken fibers on the strength of fiber reinforced composites. Author (GRA)

N72-16452# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TESTING AND CHARACTERIZATION OF COMPOSITE MATERIALS Technical Report, Jan. - Mar. 1971
J. M. Whitney Jun. 1971 47 p refs
(Task-734003)
(AD-731759; AMRL-TR-71-124) Avail: NTIS CSCL 11/4

Desirability of various test techniques for fiber reinforced composite materials is discussed from a stress analysis standpoint. Methods considered include tension tests, flexure tests, short beam shear, solid torsion rod, rail shear, and tubular specimens. Results show a tubular specimen provides the most unified procedure for complete characterization of a composite material. Tensile tests on orthotropic symmetric laminates are also shown to be useful. Flexure tests, while not desirable for precise characterization, seem useful for quality control purposes on 0 degree or 90 degree unidirectional specimens and bidirectional laminates. Author (GRA)

N72-16453# Harry Diamond Labs., Washington, D.C.
EPOXY CURING AGENTS. 1: IMIDAZOLES
Thomas J. Dearlove Sep. 1971 29 p refs
(HDL Proj. CMT91; DA Proj. 1B2-62301-A-300)
(AD-732345; HDL-TR-1551; AMCMS-Code-522A.11.62400)
Avail: NTIS CSCL 11/9

2-Ethyl-4-methylimidazole (EMI-24) cures epoxy adhesives at a moderate temperature and imparts high heat resistance to the product. Due to the tendency of EMI-24 to crystallize at room temperature, this study was undertaken to find a suitable replacement. Resins cured with EMI-24, 1-methylimidazole (MI-1), and imidazole were compared with respect to bond strength and heat deflection temperature as functions of curing-agent concentration and cure conditions. Results indicate that the physical properties of resins cured with MI-1 and imidazole are comparable with that cured with EMI-24. MI-1 has the advantages of being readily available and of being a liquid at room temperature. A published article on the mechanism of imidazole-cured epoxy resins suggests that the pot life of the adhesive system may be increased by placing deactivating substituents on the imidazole ring. Results of a study of such systems are presented. Author (GRA)

N72-16454# Midwest Research Inst., Kansas City, Mo.
ACOUSTIC EMISSION FROM BORON-ALUMINUM COMPOSITES DURING TENSILE FRACTURE AND FATIGUE
Fred R. Rollins, Jr. Oct. 1971 26 p refs
(Contract N00014-67-C-0360)
(AD-731710; TR-6) Avail: NTIS CSCL 11/4

Severe deformation of boron-aluminum composite material produces acoustic emission events that are useful in evaluating the degree of damage and in predicting imminent failure. When boron filaments are fractured the resultant acoustic emissions are quite energetic and can usually be detected even in noisy environments such as those associated with fatigue testing. During the fatigue of composites with unidirectionally aligned filaments, it is relatively common to obtain shear cracks which become sources of fretting noise. Such fretting noise is not always an indication of continuing damage and it can obscure acoustic emission events of more interest unless some form of isolation or discrimination is used. One technique for accomplishing this task is discussed. Author (GRA)

N72-16455# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. ADVANCED COMPOSITE MATERIALS
K. R. Hanby 5 Nov. 1971 15 p refs
(AD-732114) Avail: NTIS CSCL 11/4

Contents: Hybrid composites, Beryllium-wire reinforced alloys by roll bonding, Transverse strength of ductile-fiber-reinforced metals, Transverse strength of brittle-fiber-reinforced alloys, Transverse strength of Al2O3-filament reinforced nickel-chromium alloy, Explosive fabrication of aluminum/steel composites. GRA

N72-16456# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EROSIVE RESISTANCE OF ZIRCONIUM DIOXIDE, STABILIZED BY YTTRIUM OXIDE
R. I. Abraitis, V. G. Gordon, A. B. Ivanov, I. S. Mayauskas, and A. I. Rekov 16 Aug. 1971 14 p refs Transl. into ENGLISH from the publ. "Materialy dlya Kanala MGD-Generatora" Moscow, Nauka, 1969 p 63-67
(AF Proj. 314526)
(AD-731930; FTD-MT-24-108-71) Avail: NTIS CSCL 11/2

Results are presented from the study of the erosion resistance of zirconium dioxide stabilized by yttrium oxide under conditions corresponding to the function of electrodes in the channel of an open cycle type MHD generator. It is experimentally shown that the studied materials exhibit high resistance to the erosive effect of the gas flow (mass removal rate) at 2300

degrees K electrode surface temperature and 500 m/s ionized combustion product flow rate. Author (GRA)

N72-16457# Army Foreign Science and Technology Center, Charlottesville, Va.
DETERMINATION OF RESIDUAL STRESSES IN COMPOSITE MATERIALS
V. P. Severdenko, E. M. Makushok, and I. Kh. Chutaev 24 Sep. 1971 14 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz. Tekh. Navuk (Minsk), no. 4, 1969 p 77-81
(AD-731873; FSTC-HT-23-658-71) Avail: NTIS CSCL 11/4

The authors develop empirical methods for determining longitudinal stresses in fiber-reinforced materials when the history of their deformation is known. These methods are based on the peculiarities of the stress diagrams and the compression of composite materials. All three methods outlined yield very similar figures for residual stress, both in matrix and in the fibers. Author (GRA)

N72-16458# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
BASIC RESEARCH IN DYNAMIC SEALING Annual Summary Report, 1 Sep. 1970 - 31 Aug. 1971
C. F. Fisher, Jr., W. K. Stair, C. R. Brooks, A. J. Edmondson, and T. V. Blalock Oct. 1971 61 p refs
(Contract N00014-68-A-0144; NR Proj. 097-377)
(AD-732021; ME71-T57-13) Avail: NTIS CSCL 11/1

The report outlines progress and significant technical information obtained during the period September 1, 1970, through August 31, 1971, on basic research in dynamic sealing. Progress on construction of a dynamic test facility for mechanical face seals is reported. Results of a mathematical study, including inertia effects, of turbulent flow in the space between the faces of mechanical seals is reported. Results of theoretical and experimental studies of flow between porous discs is reported. Author (GRA)

N72-16459# Army Foreign Science and Technology Center, Charlottesville, Va.
PROMISING UTILIZATION OF HEAT RESISTANT COATINGS IN CHEMICAL INDUSTRY
G. I. Ivachin, V. M. Fisun, and A. S. Mashinskii 1971 14 p refs Transl. into ENGLISH from "Perspektivy Primeneniya Zharostoikikh Pokrytii v Khimicheskom Mashinostroenii" Acad. of Sci.
(FSTC Proj. T7023)
(AD-731878; FSTC-HT-23-690-71) Avail: NTIS CSCL 11/3

Utilization of heat-resistant coatings for the chemical processes where high temperatures are encountered is described. GRA

N72-16460# TRW Equipment Labs., Cleveland, Ohio.
THE TIME DEPENDENT MECHANICAL BEHAVIOR OF METAL MATRIX COMPOSITES Final Report, 1 Mar. 1970 - 28 Feb. 1971
George D. Menke and Istvan J. Toth Sep. 1971 106 p refs
(Contract F33615-70-C-1299; Task-735106)
(AD-732268; ER-7274-5) Avail: NTIS CSCL 11/4

The tensile, fatigue, and creep bending behavior of unidirectional and cross-plied composites of 60 volume percent boron filaments in a matrix of 6061 aluminum was investigated. The tensile strength properties of the composites fabricated as a part of this program show that the fabrication technique of diffusion bonding foil-filament arrays produces high strength, high quality material. The major part of this report deals with measurement and analyses of fatigue properties. Fatigue behavior was investigated under both axial and flexural loading conditions, with variables of filament orientation, test temperature and A-ratio. Notch sensitivity was also investigated; fatigue of the composite was found to be insensitive to notch radius. Fatigue damage was analyzed by residual strength measurement, filament extraction, scanning electron microscopy, metallography, radiography, and other techniques. The theory that the fatigue properties are controlled by the fatigue behavior of the matrix was confirmed and reinforced by the current investigation. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-16461*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
FOUNDATIONS FOR ESTIMATION BY THE METHOD OF LEAST SQUARES
Walter W. Hauck, Jr. 27 Dec. 1971 94 p refs
(Grant NGR-09-015-002)
(NASA-CR-125549; SAO-Special-Rept-340; Rept-009-113) Avail: NTIS CSCL 12A

Least squares estimation is discussed from the point of view of a statistician. Much of the emphasis is on problems encountered in application and, more specifically, on questions involving assumptions: what assumptions are needed, when are they needed, what happens if they are not valid, and if they are invalid, how that fact can be detected. Author

N72-16462*# Maryland Univ., College Park. Computer Science Center.
EIGENVALUES OF THE LAPLACIAN OF A GRAPH
William N. Anderson, Jr. and Thomas D. Morley 6 Oct. 1971 8 p refs
(Grants NGR-21-002-008; NSF GY-8987)
(NASA-CR-125547; TR-71-45) Avail: NTIS CSCL 12A

Let G be a finite undirected graph with no loops or multiple edges. The Laplacian matrix of G, Delta(G), is defined by Delta sub ii = degree of vertex i and Delta sub ij = -1 if there is an edge between vertex i and vertex j. The structure of the graph G is related to the eigenvalues of Delta(G); in particular, it is proved that all the eigenvalues of Delta(G) are nonnegative, less than or equal to the number of vertices, and less than or equal to twice the maximum vertex degree. Precise conditions for equality are given. Author

N72-16463# Montpellier Univ. (France). Lab. de Physique Mathematique.
RELATION BETWEEN THE THREE DIMENSIONAL FREDHOLM DETERMINANT AND THE JOST FUNCTIONS
Roger G. Newton Dec. 1971 14 p refs Sponsored in part by AROD, NSF, and Cnrs Prepared in cooperation with Indiana Univ., Bloomington
(PM/71/11) Avail: NTIS

It is proved that the modified Fredholm determinant F of the three-dimensional Lippmann-Schwinger equation in the theory of scattering by spherically symmetric potentials is related to the Jost functions of angular momentum. The relation between the multiplicity of the zeros of F and the degeneracy is discussed, and a relevant theorem for Hilbert-Schmidt operators is proved. Author

N72-16464# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE BICANONICAL SYSTEMS
Christian Marchal 1971 13 p refs Presented at the 4th Congr. on Optimization Techniques, Los Angeles, 19-22 Oct. 1971
(ONERA-TP-1006) Avail: NTIS

Bicanonical systems are differential systems which satisfy the conditions of canonicity in the generalized sense of Contensou

and also in the generalized sense of Pontryagin; they often appear in optimization problems. The conditions of bicanonicity are given and the properties of bicanonical systems are developed. These properties are useful for theoretical studies as well as for numerical computations. Author

N72-16465# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

PHENOMENOLOGICAL WEAK SCALING THEORY

W. K. Theumann Dec. 1971 22 p refs

(LPTHE-71/60) Avail: NTIS

Arguments are presented which characterize weak scaling correlations in terms of thermodynamic homogeneity. Using as a guide the present indications on the spin-spin correlation function of the three-dimensional Ising model, it is shown that the thermodynamic effects of the smooth deviations from strong scaling, in dimension d greater than 2, can be accounted for most easily by looking at the correlations at a second, effective length zeta = zeta(psi), much smaller than the correlation length. This depends on a constant psi, a non-zero value of which indicates deviation from strong scaling, and zeta (psi) is determined as that length over which an effective strong scaling correlation in dimension (d - psi) yields the expected scaling relation.

Author

N72-16466# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

RESEARCH ON THE DESIGN OF NEAR-OPTIMAL CONTROLLERS

Harold K. Knudsen Jun. 1971 54 p refs Prepared for Sandia Labs.

(Sandia-51-0059)

(SC-CR-715127; EE-199(71)-SAN-183) Avail: NTIS

This research has been directed towards the realization of near-optimal feedback controllers for two classes of problems; a near-time-optimal control problem with a linear plant, and a more general near-optimal problem. The controller realization for the near-time-optimal problem is based on sets in state space called S sub P sets. Approximation methods are developed for the boundaries of the S sub P sets. Algorithms which generate approximations to the S sub P sets are also developed. A theory of near-optimal control is partially developed for the more general problem. Also, algorithms for the realization of the corresponding control policies are outlined. Research on the implementation of controllers which have control policies specified by surfaces in state space has also been performed. Author

N72-16467# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.

PRINCIPLE OF INFORMATION FLOW FOR THE TREATMENT OF DISCONTINUITIES IN SYNTHESIS TECHNIQUES

Martin Becker [1971] 22 p refs

(Contract AT(30-1)-328)

(RPI-328-231) Avail: NTIS

Discontinuous trial function methods are useful in various nuclear engineering applications. One of the problems associated with such methods is the unambiguous specification of interface conditions. The application of the asymmetric discontinuity approach to both initial-value and boundary-value problems is described. NSA

N72-16468# California Univ., Berkeley. Operations Research Center.

A MORE GENERAL SOLUTION OF DETERMINISTIC OPTIMAL CONTROL PROBLEMS WITH LINEAR DYNAMICS AND QUADRATIC CRITERION

Stuart E. Dreyfus and Yi ChiKan Aug. 1971 22 p refs

(Contract DA-31-124-ARO(D)-331; DA Proj. 200-14501-B-14-C)

(AD-731836; ORC-71-22; AROD-5307-61-M) Avail: NTIS CSCL 12/1

An optimal control problem with linear dynamics and quadratic criterion is imbedded in a family of problems characterized by both initial and terminal points. The optimal value function is jointly quadratic in initial and terminal points and the optimal control is jointly linear. Recursive formulas for the coefficients of these functions are developed. This generalized procedure can be used to solve several versions of the problem not solvable by the standard one-ended imbedding technique. In particular, a procedure doubling the number of stages at each iteration is given for problems with coefficients not varying with the stage. Author (GRA)

N72-16469# Brandeis Univ., Waltham, Mass. Dept. of Mathematics.

MODERN DIFFERENTIAL EQUATION TECHNIQUES FOR PROBLEMS IN AERODYNAMICS AND ELECTROMAGNETICS Final Scientific Report

Richard S. Palais 9 Sep. 1971 15 p refs

(Grant AF-AFOSR-1403-68TR; AF Proj. 9749)

(AD-732315; AFOSR-71-2719TR; Rept-61102F; Rept-681304) Avail: NTIS CSCL 12/1

One report summarizes the research results obtained under Grant AFOSR-68-1403 during the period 1 September 1967 through 31 August 1971, from the initiation to the expiration of this grant. Results were obtained in the major areas of critical point theory, the theory of manifolds of sections of fiber bundles, the weak topology of nonlinear analysis, and in fluid mechanics. In turn, these concern the solutions of nonlinear problems by the critical point method, and the method of steepest descent, the differential topological and differential geometric structure of infinite dimensional manifolds of sections of fiber bundles, the theory of intrinsically bounded sets and the theory of manifolds with a globally defined weak-bounded topology, weak manifolds, and a physically-realistic model for fluid mechanics, allowing compressibility and taking thermodynamic variables and heat conduction into account. Author (GRA)

N72-16470# Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

A STUDY OF WEAKLY NONLINEAR DYNAMICAL SYSTEMS AND THEIR STABILITY Final Scientific Report, 16 Sep. 1965 - 15 Aug. 1971

P. R. Sethna Nov. 1971 12 p refs

(Grant AF-AFOSR-0704-66; AF Proj. 9749)

(AD-732212; AFOSR-71-2812TR) Avail: NTIS CSCL 12/1

The research results are concentrated in four major areas. The first concerns the local behavior of dynamical systems, in particular, nonautonomous systems represented by systems of ordinary differential equations almost periodic in time and dependent on a parameter. The main results concern methods for obtaining approximations to solutions that approach stable almost periodic solutions as time goes to infinity. The second concerns systems dependent on fast and slow time, in particular asymptotic results valid for all time for such systems. The results are applied to obtain physically important results for dynamical systems with parametric excitation of high frequency. The third concerns a new approach to the method of averaging, in particular a generalization applicable to a broader class of systems. The basic approach employs arguments related to Liapunov converse theorems. The fourth concerns gyroscopic systems with high spin gyroscopes, in particular results valid for finite intervals of time, and results pertaining to periodic solutions of high spin gyroscopic systems. Author (GRA)

N72-16471# Rice Univ., Houston, Tex. Aero-Astronautics Group.

COMBINED GRADIENT-RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS

Angelo Miele 1971 22 p refs

(Grant AF-AFOSR-0828-67; AF Proj. 9749)

(AD-732333; AAR-91; AFOSR-71-2693TR) Avail: NTIS CSCL 12/1

The paper considers the problem of minimizing a functional I which depends on the state x(t), the control u(t), and parameter

pi. Here, l is a scalar, x an n-vector, u an m-vector, and pi a p-vector. At the initial point, the state is prescribed. At the final point, the state and the parameter are required to satisfy q scalar relations. Along the interval of integration, the state, the control, and the parameter are required to satisfy n scalar differential equations. A combined gradient-restoration algorithm is presented: this is an iterative algorithm characterized by variations delta x(t), delta u(t), delta pi leading toward the minimal condition while simultaneously leading toward constraint satisfaction.

Author (GRA)

N72-16472# Rice Univ., Houston, Tex. Aero-Astronautics Group.

COMPUTING METHODS IN APPLIED MATHEMATICS Final Report, 1 Oct. 1970 - 30 Sep. 1971

Angelo Miele 30 Sep. 1971 14 p refs

(Grant AF-AFOSR-0828-67)

(AD-732216; AFOSR-71-2687TR) Avail: NTIS CSCL 12/1

The objective of this investigation is to contribute to computing methods in applied mathematics. The study involves theoretical analyses and development of examples having current interest. The theoretical analyses are concerned with (a) solution of nonlinear, algebraic or transcendental equations, (b) solution of nonlinear, ordinary differential equations, (c) solution of nonlinear, partial differential equations, (d) mathematical programming problems, (e) optimal control problems involving ordinary differential equations, and (f) optimal control problems involving partial differential equations. The examples are concerned with particular problems occurring in flight mechanics, astrodynamics, aerodynamics, and stability and control of aerospace vehicles. The main analytical results, summarized in seven reports and five articles, are described. GRA

N72-16473# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

THE DISTRIBUTION OF A TRUNCATED LINEAR DIFFERENCE BETWEEN INDEPENDENT CHI-SQUARE VARIATES Final report

David A. Harville Aug. 1971 27 p refs

(AF Proj. 7071)

(AD-732287; ARL-71-0131) Avail: NTIS CSCL 12/1

A comprehensive account is given of the properties of the distribution of a doubly-truncated linear difference between two independent chi-square variates. Expressions for the probability density function, distribution function, moments, moment generating function, and characteristic function of the distribution are obtained, primarily by making use of known results on hypergeometric functions. Emphasis is placed on representations thought to be useful for computations. In general, simple expressions are possible only when at least one of the chi-squares has an even number of degrees of freedom. The results should prove useful in studying the properties of truncated quadratic estimators of variance components.

Author (GRA)

N72-16474# Hughes Aircraft Co., Fullerton, Calif. Systems Effectiveness Dept.

BAYESIAN RELIABILITY DEMONSTRATION. PHASE 2: DEVELOPMENT OF A PRIORI DISTRIBUTION Final Technical Report, Mar. 1970 - Jun. 1971

R. E. Schafer and T. S. Sheffield Oct. 1971 101 p refs

(Contract F30602-70-C-0196)

(AD-732283; RADC-TR-71-209) Avail: NTIS CSCL 12/1

The final report is a result of a study performed as the second phase of a three phase effort to develop Bayesian Reliability Demonstration Tests (BRDT). The objectives of this, the second phase, were: To fit additional prior distributions; Develop a preliminary format for BRDT; Test the receptiveness to BRDT; Study methods of modifying prior distributions in the face of new data; Study the possible application of empirical Bayes methods to RDT. It turns out that the inverted gamma distribution remains a good choice for a prior distribution, the Bayes tests are economical and easily implemented and tabulated, the Industry/Government interest in such cases is high, and finally, the linear model is a plausible model for modifying prior distributions.

Author (GRA)

N72-16475# North Carolina Univ., Chapel Hill. Dept. of Statistics.

SOME PROBLEMS IN THE THEORY OF POINT PROCESSES

D. J. Daley Aug. 1971 18 p refs

(Contract N00014-67-A-0321-0002; NR Proj. 042-214)

(AD-731697; Mimeo-Ser-772) Avail: NTIS CSCL 12/1

The report contains an account of certain unsolved and partially solved problems of point process theory. These problems were the subjects of discussions between participants at the International Statistics Institute Satellite Conference on Point Processes held at I.B.M. Watson Research Labs, August, 1971.

Author (GRA)

N72-16476# Stanford Univ., Calif. Information Systems Lab.

A DISTRIBUTIONAL-MODULE THEORETIC REPRESENTATION OF LINEAR DYNAMICAL CONTINUOUS-TIME SYSTEMS

Edward W. Kamen May 1971 149 p refs Sponsored in part by NSF

(Contract N00014-67-A-0112-0044)

(AD-731701; SU-SEL-71-044; TR-6560-24) Avail: NTIS CSCL 12/1

The document presents a new algebraic representation of linear constant continuous-time dynamical systems without the use of Laplace transform techniques. In particular, new results are given on the realization of multiterminal systems with special emphasis on lumped-distributed systems or networks. The theory begins with a precise definition of linear continuous-time dynamical systems in the input/output sense. More specifically, the input/output behavior of a linear system is defined in terms of a zero state input/output map whose domain and range consist of 'generalized functions' or Schwartz distributions. The fundamental problem of concern here, which is called the problem of realization, is the determination of the internal structure and properties of a linear system given only its zero state input/output map.

Author (GRA)

N72-16477# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.

A NEGATIVE DEFINITE EQUILIBRIUM AND ITS INDUCED CONE OF GLOBAL EXISTANCE FOR THE RICCATI EQUATION

Richard S. Bucy and Jose Rodriguez-Canabal Oct. 1971 6 p refs

(Grants AF-AFOSR-2141-71; DA-ARO(D)-31-124-71-G637; AF Proj. 9749)

(AD-732238; AFOSR-71-2785TR; Rept-61102F; Rept-681304) Avail: NTIS CSCL 12/1

The domain of global existence for the Riccati equation is shown to include a cone with vertex at the negative definite equilibria and containing the positive definite equilibria, under regularity conditions.

Author (GRA)

N72-16829 Naval Civil Engineering Lab., Port Hueneme, Calif.

DIGITAL FOURIER ANALYSIS OF MECHANICAL SHOCK DATA

H. A. Gaberson and D. Pal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 39-52 refs (See N72-16824 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16238# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

THE FORMING OF NORMAL EQUATIONS FOR THE ADJUSTMENT OF OBSERVATION EQUATIONS BY EDP

METHODS
Dieter Ehlert *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 11-14 refs (See N72-16236 07-13)
Avail: NTIS

N72-16244# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
PROBLEMS OF THE ADJUSTMENT OF LARGE TRAVERSE NETS ON THE ELLIPSOID
Peter Wilson *In its* Inform. Relative to Cartography and Geodesy, ser. 2, no. 28 1971 p 53-64 refs (See N72-16236 07-13)
Avail: NTIS

N72-16115# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany).
AN APPLICATION OF THE MONTE CARLO METHOD TO REMOTE SENSING SYSTEMS
J. Roettger *In* AGARD Propagation Limitations in Remote Sensing Oct. 1971 10 p refs (See N72-16085 07-07)
Avail: NTIS HC $6.00/MF $0.95

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-16478# Coastal Plains Center for Marine Development Services, Wilmington, N.C.
BIBLIOGRAPHY ON HURRICANES AND SEVERE STORMS OF THE COASTAL PLAINS REGION, SUPPLEMENT 1
Harold W. Dubach and Frederick Betz, Jr. Jan. 1972 18 p refs
(Publ-72-1) Avail: NTIS

The supplement contains 147 additional titles printed from 1924 through 1971, and has subject and author indexes. N.E.N.

N72-16479*# Chicago Univ., Ill. Satellite and Mesometeorology Research Project.
PROPOSED CHARACTERIZATION OF TORNADOES AND HURRICANES BY AREA AND INTENSITY
T. Theodore Fujita Feb. 1971 46 p refs
(Grants NGR-14-001-008; NOAA-N22-198-68(G); NOAA-N22-24-71(G))
(NASA-CR-125545; SMRP-91) Avail: NTIS CSCL 04B

Results of the 1968 through 1970 Tornado Watch Experiment conducted jointly by NASA and NOAA suggested the necessity of characterizing individual tornadoes in order to improve the identity of tornado-producing nephsystems. An attempt was made, therefore, to categorize each tornado by its intensity and area. Fujita-scale wind and corresponding damage categories were devised to classify tornadoes as Gale (F0), Weak (F1), Strong (F2), Severe (F3), Devastating (F4), and Incredible (F5). Additionally, individual tornado areas were also categorized as Trace (TR), Decimicro (DM), Micro (MI), Meso (ME), Marco (MA), Giant (GI), and Decagiant (DG), thus permitting characterizing of a tornado by a combination of intensity and area, such as weak decimicro tornado, severe meso tornado, or incredible giant tornado. A test characterization of 156 Japanese tornadoes in 1950-69 was accomplished for comparison with 893 U.S. tornadoes in 1965. Unexpectedly, the percentage distribution of intensity and individual area of U.S. and Japanese tornadoes is very similar except for large and/or intense ones. Intensity distribution within the Dallas and Fargo tornadoes of 1957 was also studied in detail. It was also found that the F-scale variation along the paths of family tornadoes shows an intensity oscillation with a 45-min interval. Author

N72-16480# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11607 LANCE, MISSILE NO. 2133, ROUND NO. 128 (21 SEPTEMBER 1971) Meteorological Data Report
Sep. 1971 24 p refs
(Task-665702-D-12702)
(AD-732330; DR-667) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11607 Lance, Missile Number 2133, Round Number 128, are presented in tabular form. Author (GRA)

N72-16481# Istituto di Fisica Dell Atmosfera, Rome (Italy).
OUTLINES OF A METEOROLOGICAL SATELLITE PROJECT FOR THE MEDITERRANEAN AREA
M. Giorgi and M. Colacino [1971] 11 p refs Presented at the 11th DGLR European Space Symp., Berlin, 24-26 May 1971
Avail: NTIS

Following a brief review of peculiarities in Mediterranean meteorology and the problems involved in accurate forecasting for this area, a project is proposed for an operational system of meteorological satellites. It is suggested that four satellites be launched in a polar orbit, stabilized on three axes, and be capable of conducting surveys in the visible and infrared range. These satellites would also be required to interrogate the automatic stations and buoys in all locations of the area under investigation. Problems involved with the ground equipment are discussed, and include those relating to the automatic stations and the data collecting and processing center. Author (ESRO)

N72-16482# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
OMSS: AN OPERATIONAL METEOROLOGICAL SATELLITE SYSTEM FOR SPECIFIC EUROPEAN REQUIREMENTS
A. V. Breitenstein, D. E. Koelle, and W. Mueller [1971] 30 p Presented at the 11th DGLR European Space Symp., Berlin, 24-26 May 1971
(MBB-UR-76-71-O) Avail: NTIS

The needs for meteorological data for weather forecasting in Europe are discussed. Existing projects within the Global Atmospheric Research Program and the World Weather Watch are reviewed. Because of the special needs of Europe for undistorted measurements in the northern regions and for continuous weather observations, a special solution is proposed using an operational meteorological satellite system consisting of two satellites on inclined geosynchronous orbit. The orbital elements are discussed and the onboard equipment defined. Some indications are given on the weight and power budget.
ESRO

N72-16483# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
SECOM: A NEW CONCEPT FOR COMMUNICATION SATELLITES WITH ELECTRICAL PROPULSION FOR THE EUROPA 2 LAUNCHER
H. Schweig 1971 21 p Presented at the 11th DGLR European Space Symp., Berlin, 24-26 May 1971
(MBB-UR-75-71-O) Avail: NTIS

Present day performance of Europa 2 launched from Guiana limits the capacity of telecommunication satellites necessary to cover the European needs. Investigations have been made to ascertain the feasibility of a combination of chemical and solar electric propulsion for orbit transfer of an improved European communication satellite to cover the gap from 1973 to 1980 when the ESRO telecom will be ready for launch. Transfer time and related problems such as degradation of solar arrays and thickness of glass coating are discussed. ESRO

N72-16484# Institut Royal Meteorologique de Belgique, Brussels. Regie des Volies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Mar. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL,

MARS 1970]
1971 32 p In FRENCH and DUTCH
Avail: NTIS
Synoptic measurements made at different Belgian weather stations in March 1970 are presented. LSRO

N72-16485# Institut Royal Meteorologique de Belgique, Brussels. Regie des Voies Aeriennes et Force Aerienne.
SYNOPTIC OBSERVATIONS Monthly Bulletin, Jul. 1970 [OBSERVATIONS SYNOPTIQUES BULLETIN MENSUEL, JUILLET 1970]
1971 32 p In FRENCH and DUTCH
Avail: NTIS
Synoptic measurements made at different Belgian weather stations in July 1970 are presented. ESRO

N72-16486# Naval Scientific and Technical Intelligence Center, Washington, D.C. Translation Div.
A DEVICE FOR PRODUCING ARTIFICIAL VERTICALLY-DIRECTED HEAT CURRENTS
V. I. Vinogradov and V. I. Skatski 10 Sep. 1971 9 p ref Transl. into ENGLISH from Fiz. Oblakov i Adtivnykh Vozdeistvii, Tr. (Moscow), no. 12, 1970 p 90-95
(AD-730476; NAVSTIC-Trans-3246) Avail: NTIS CSCL 04/2
A device is described which is used to create vertically directed jets of heated air. The device is assembled on the basis of four aircraft gas turbine jets type RD-3M. The device design, its principal units, systems and aggregates and also technical data of the device are described. Author (GRA)

N72-16487# Weather Squadron (17th), Norton AFB, Calif. Detachment 03.
TERMINAL FORECAST REFERENCE FILE, NORTON AFB, CALIFORNIA Final Report
Aug. 1971 120 p
(AD-729212) Avail: NTIS CSCL 04/2
The reference file discusses factors affecting the weather at Norton AFB, California. Included are location and topography, weather controls, climatic aids, and local forecast studies. Author (GRA)

N72-16488# Air Weather Service, Scott AFB, Ill.
WEATHER WARNINGS AND SPECIALIZED FORECASTS
1 Oct. 1971 20 p refs Revised
(AD-732263; AWS-Manual-105-8-Vol-1-Rev) Avail: NTIS CSCL 04/2
The manual states policy, outlines responsibilities, and prescribes procedures for providing weather warnings and specialized forecast support to authorized recipients. AWS/DO is OPR for volume I, which applies to all AWS units. AWS Forms 39 and 39a are prescribed in this volume. Author (GRA)

N72-16489# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12802 LANCE, MISSILE NO. 2137, ROUND NO. 131 SBL (15 OCTOBER 1971) Meteorological Data Report
Oct. 1971 42 p
(DA Proj. 1T6-65702-D-127)
(AD-732348; DR-673) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 12802 Lance, Missile Number 2137, Round Number 131 SBL, are presented in tabular form. Author (GRA)

N72-16490# Environmental Technical Applications Center (Air Force), Washington, D.C.
NUMERICAL PREPROCESSING OF RAWINSONDE POSITION VECTORS
Thomas E. Stanton Oct. 1971 67 p refs
(AD-732205; USAFETAC-TN-71-11) Avail: NTIS CSCL 04/2
Martin-Graham filters are used subsequent to correction for erroneous data points to smooth the rawinsonde set AN/GMD-4 spherical measurements. This smoothing produces not only a corrected wind profile but also allows an orderly pressure integration of the hydrostatic equation. The major data problems besides high frequency elevation-angle noise include range jumps and diffraction phenomena. The range jumps are identified and corrected through the inspection of first and second differences in the range field. The diffraction phenomena are adjusted by assuming a linear change in the balloon-ascent-rate field and reconstructing the elevation angles. Erroneous data due to other causes are adjusted by comparing filtered with raw data and imposing limitations on the height, wind, and position vector fields. Author (GRA)

N72-16491# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11601 LANCE, MISSILE NO. 2117, ROUND NO. 124 SBT (20 AUGUST 1971) Meteorological Data Report
Aug. 1971 54 p
(Task-1T6-65702-D-127-02)
(AD-732326; DR-659) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 11601 Lance, Missile Number 2117, Round Number 124 SBT, are presented in tabular form. Author (GRA)

N72-16492# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
HUNTER-LIGGETT M. R., CALIFORNIA NACIMIENTO, CENTRAL STONEY, SAN MIGUELITO, HIGH POINT, PALISADES Meteorological Data Report
Mar. 1971 107 p
(AD-731788) Avail: NTIS CSCL 04/2
The report contains the following meteorological data collected at sites within the Hunter-Liggett during March 1971: Atmospheric precipitation; Atmospheric temperature; Atmospheric pressure; Humidity; Wind. GRA

N72-16493# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
HUNTER-LIGGETT M. R., CALIFORNIA, MILPITAS, ALPHA, IRUS, JOLON, SAM JONES Meteorological Data Report
Mar. 1971 117 p
(AD-731787) Avail: NTIS CSCL 04/2
The report contains the following meteorological data collected at sites within the Hunter-Liggett military reservation during March 1971: Atmospheric precipitation; Atmospheric Temperature; Atmospheric pressure; Humidity; Wind. GRA

N72-16494# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11602 LANCE, MISSILE NO. 2125, ROUND NO. 125 SBT (27 AUGUST 1971) Meteorological Data Report
Sep. 1971 62 p
(Task-1T6-65702-D-127-02)
(AD-732327; DR-662) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 11601 Lance, Missile Number 2125, Round Number 125 SBT, are presented in tabular form. Author (GRA)

N72-16495# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11607 LANCE, MISSILE NO. 5150, ROUND NO. 126 RCT (3 SEPTEMBER 1971) Meteorological Data Report
Sep. 1971 24 p
(Task-1T6-65702-D-127-02)
(AD-732328; DR-664) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 11607 Lance, Missile Number 5150, Round Number 126 RCT, are presented in tabular form. Author (GRA)

N72-16496# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 13001 HONEST JOHN LASER, MISSILE NO. 130 ROUND NO. 611 (9 SEPTEMBER 1971) Meteorological Data Report
Sep. 1971 29 p
(Task-T-665702-D-12702)
(AD-732329; DR-665) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 13001 Honest John Laser, Missile Number 130, Round Number 611, are presented in tabular form. Author (GRA)

N72-16497# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATHENA V-126 D, FLIGHT 132 (16 SEPTEMBER 1971) Meteorological Data Report
Len E. Carter Sep. 1971 57 p refs
(Task-665702-D-12702)
(AD-732331; DR-668) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of Athena Flight 132, Vehicle V-126 D, are presented for the Air Force Space and Missile Systems Organization and for ballistic studies. The data are presented in tabular and figure form. Author (GRA)

N72-16498# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 08508 HONEST JOHN MISSILE NO. 335, ROUND NO. 612 RML (28 SEPTEMBER 1971) Meteorological Data Report
Oct. 1971 20 p
(Task-1T665702D127-02)
(AD-732332; DR-671) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 08508 Honest John, Missile Number 335, Round Number 612 RML, are presented in tabular form. Author (GRA)

N72-16499# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12801 LANCE, MISSILE NO. 2109, ROUND NO. 130 ESL (1 OCTOBER 1971) Meteorological Data Report
Oct. 1971 84 p
(Task-1T6-65702-D-127-02)
(AD-732347; DR-672) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 12801 Lance, Missile Number 2109, Round Number 130 ESL, are presented in tabular form. Author (GRA)

N72-16500# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
MAYNARD, MASSACHUSETTS, CENTRAL METEOROLOGICAL OBSERVATORY Meteorological Data Report
Feb. 1971 68 p
(AD-731390) Avail: NTIS CSCL 04/2
The report contains meteorological data collected at the Central Meteorological Observatory, Maynard, Massachusetts during February 1971. GRA

N72-16501# Armament Development and Test Center, Eglin AFB, Fla.
AN OBJECTIVE AID FOR FORECASTING FOG/STRATUS AT EGLIN AIR FORCE BASE Final Report, 1 Nov. 1970 - 31 May 1971
George D. Greenly, Jr. and James E. Bralley Oct. 1971 15 p refs
(AD-732289; ADTC-TR-71-130) Avail: NTIS CSCL 04/2
An objective forecast aid is presented to forecast the occurrence of fog/stratus during the period 1 November through 31 May. Parameters conducive to fog/stratus formation are identified and subjectively weighted by points. The point total delineates three categories of occurrence or non-occurrence, with a fourth category being non-applicable due to wind speeds. Three winter seasons of independent data were used to check the study (1968-1969, 1969-1970, and 1970-1971). Author (GRA)

N72-16502# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
REDUNDANT MEASUREMENTS IN ATMOSPHERIC VARIABILITY EXPERIMENTS
Louis D. Ducan Jun. 1971 23 p
(DA Proj. 1T0-61102-B-53-A)
(AD-732343; ECOM-5391) Avail: NTIS CSCL 04/2
Direct estimates of the variability of meteorological parameters are amplified by the error variances of the measuring system. It is shown that by taking one more redundant (duplicate but independent) measurements the measurement error contribution can be removed and at the same time estimates of the error variances obtained. Only very reasonable assumptions, which are stated in the paper, are required for the analyses. GRA

N72-16503# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 12804 LANCE, MISSILE NO. 2128, ROUND NO. 129 SBT (24 SEPTEMBER 1971) Meteorological Data Report
Sep. 1971 74 p
(DA-Task-1-T-665702-D-12702)
(AD-732346; DR-669) Avail: NTIS CSCL 04/2
Meteorological data gathered for the launching of 12804 Lance, Missile Number 2128, Round Number 129 SBT, are presented in tabular form. Author (GRA)

N72-16504# Texas A&M Univ., College Station. Dept. of Oceanography and Meteorology.
A COMPARISON OF MOMENTUM FLUXES DETERMINED FROM TIME AND SPACE STRUCTURE FUNCTIONS
Jimmy Darrell Cain Aug. 1971 100 p refs
(Contract Nonr-2119(04); N00014-68-A-0308-0002; TAMRF Proj. 286-11)
(AD-731691; A/M-REF-71-22-T) Avail: NTIS CSCL 04/2
Estimates were made of the rate of turbulent energy dissipation and of the shearing stress at a height of 10 m in the marine atmosphere from measurements taken aboard R.P.Flip during BOMEX, 17-28 May 1969. Two types of structure functions were used in determining energy dissipation rate and shearing stress: the mean square of the difference in wind speed between two points aligned normal to the mean wind, D(3), and the mean square of the difference observed between two times at a fixed point in space, D(2). Comparisons were made between the two methods to improve knowledge of the relationships uniting them. Results indicated a relationship of the form D(2) = gamma D(3) where gamma approx. = 0.8 under existing conditions. Further investigation of this relationship is needed in order to interpret properly results obtained from the space-based structure function, which is less affected by platform motion at sea than is the time-based structure function. Related drag coefficients revealed, somewhat unexpectedly, a Neumann-type decrease with mean wind speed over a range of 5-11 m/sec. Diurnal variations in resulting values of wind stress were also examined and, based on a very limited sample, a semidiurnal variation was indicated. This variation showed an apparent correlation with observed diurnal variations in other meteorological parameters. In addition, computations were made of the universal constant in Kilmogorov's third similarity hypothesis and values obtained were found to agree qualitatively with results of earlier investigators. Author (GRA)

N72-16505# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
RADAR HURRICANE RESEARCH Final Report, 1 Sep. 1970 - 31 Aug. 1971
H. V. Senn Sep. 1971 65 p refs
(Contract NOAA-E22-56-71(N))

(AD-732249; ML-71095) Avail: NTIS CSCL 04/2

Studies were made of the quantitative nature of precipitation in the three hurricanes on which such data were obtained by the U. M. Radar Meteorological Laboratory. Although IEC units were different for each of the storms, the data were amenable to the calculation of radar attentuation statistics along various observed path lengths of known minimum precipitation rates. Highest rainfall rates were observed in Betsy 1965 where a path of 72 n mi of nearly 1 per hr (plus some lighter precipitation along the same path) would have caused at least 87 db attenuation at X-band, 29 db at C-band and a bit less than 4 db at S-band wavelengths. Another study was made of radar precipitation echo heights in hurricanes using data from both the U. M. Radar Meteorological Laboratory and U. S. N. WEARECONRON FOUR radars. Although a significant number of echoes penetrate the 30-35,000-ft levels at greater ranges, it was found that most of the taller echoes are within 20 n mi of the eyewall. Furthermore, most of the taller echoes are found in the north and east segments and the areas of such echoes remain rather constant with respect to the moving storm center. Author (GRA)

N72-16506# Weather Squadron (15th), Charleston, S.C. Detachment 03.
TERMINAL FORECAST REFERENCE FILE FOR MCGUIRE AFB, NEW JERSEY Final Report
20 Oct. 1971 131 p
(AD-732292) Avail: NTIS CSCL 04/2

The reference file discusses factors affecting the weather at McGuire AFB, N. J. Included are location and topography, weather controls, climatic aids, and local forecast studies.
Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-16507*# TRW Systems Group, Redondo Beach, Calif.
THE OGO ATTITUDE CONTROL SUBSYSTEM REDESIGN AS A RESULT OF OGO 3 EXPERIENCE. VOLUME 1: SYSTEM ANALYSIS AND DESIGN STUDIES Final Report
K. J. McKenna 30 Jun. 1967 198 p refs
(Contract NAS5-899)
(NASA-CR-122323; TRW-67-7231.7-116-Vol-1) Avail: NTIS CSCL 22B

An oscillation in the OGO-3 roll control channel, resulting from the EP-5 and EP-6 boom motion coupling into the control channel and causing loss of attitude control, is investigated. The study includes (1) an analysis of the OGO-3 and OGO-2 flight data to determine the nature and extent of the roll oscillation phenomena, (2) design analysis of the complete attitude control subsystem (ACS) to evolve changes which would prevent recurrences of the coupled ACS boom oscillation observed on OGO-3, and (3) analog simulations to verify the performance of the design changes selected. Portions of OGO-3 and OGO-2 flight data are illustrated and the major flexible body oscillation are identified. A model of the major flexible appendage dynamics is developed and is shown analytically and through analog simulations to reproduce the OGO-3 oscillation phenomena. The design changes which were found necessary are: a reversal delay logic for the roll reaction wheels, widening of the solar array dead zone from 0.5 to 1.0 deg, and modification of the OPEP control loop to include a filter and stabilizing feedback loops. Author

N72-16508*# Sperry Rand Corp., Phoenix, Ariz. Flight Systems Div.
STUDY OF AUTOMATIC AND MANUAL TERMINAL GUIDANCE AND CONTROL SYSTEMS FOR SPACE SHUTTLE VEHICLES Final Report, Apr. - Jun. 1971
Stephen Osder and Roger Keller Dec. 1971 58 p refs
(Contract NAS2-5804)
(NASA-CR-114407; Rept-71-0225-00-01) Avail: NTIS CSCL 22B

A summary of the aerodynamic characteristics of the delta orbiter space shuttle vehicle is presented. Selected guidance and control system parameters, flight path geometry, landing performance obtained with winds and turbulence, and the influence of vehicle L/D on that performance are included.
Author

N72-16509# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
USING ATOMIC CLOCKS FOR SPACECRAFT LOCATION
Roland Moreau 1971 12 p refs Presented at the meeting of the IEEE INTERCON, Lausanne, 18-22 Oct. 1971
(ONERA-TP-1020) Avail: NTIS

After a review of the principles of clock trajectory, some ONERA experiments with aircraft which had accuracies of a few meters are described. The synchronization of ground stations is discussed, and other experiments, across the Atlantic, with accuracies of thirty nonoseconds are also described. It is suggested that the use of pulsed lasers would improve the accuracy of this system by a factor of 10. It is recommended that these techniques be used for locating space shuttles.
Author

N72-16510*# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
VHF RANGING AND POSITION FIXING EXPERIMENT USING ATS SATELLITES: FINAL REPORT ON PHASES 1 AND 2, 25 NOVEMBER 1968 - 1 MAY 1971
1 May 1971 349 p refs
(Contract NAS5-11634)
(NASA-CR-125538; S-71-1109) Avail: NTIS HC $3.00/MF $0.95 CSCL 17G

The testing program with the ATS-1 and ATS-3 spacecraft showed that geostationary satellites can provide superior communications and position surveillance for mobile craft. Inexpensive modifications to conventional mobile communications equipment aboard the craft can provide reliable, high quality voice and digital communications with distant ground stations and other vehicles, and automatic surveillance of the positions of all the craft by a ground facility. The tests also demonstrated the location and automatic readout of remote data collection platforms. Frequency modulation signals with the narrow audio and radio frequency bandwidths of terrestrial mobile radio communications were relayed through the VHF transponders of the geostationary satellites. The voice and digital communications were far superior in reliability and quality to long-distance mobile communications by other means. It was shown that one satellite can provide nearly uniform high quality performance over approximately one-third of the earth's surface. Position fixes by range measurement from the two satellites were accurate to approximately one nautical mile, except near the equator and the poles. Author

N72-16511*# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
VHF RANGING AND POSITION FIXING EXPERIMENT USING ATS SATELLITES: EXECUTIVE SUMMARY OF FINAL REPORT ON PHASES 1 AND 2, 25 NOVEMBER - 1 MAY 1971
1 May 1971 29 p ref
(Contract NAS5-11634)
(NASA-CR-125537; S-71-1109) Avail: NTIS CSCL 17G

The VHF transponders of the ATS-1 and ATS-3 geostationary satellites were used in ranging and position fixing experiments. An interrogation signal was transmitted from a ground terminal to ATS-3, which relayed it to the vehicle transponders. The vehicle that was addressed repeated the signal and its response was relayed back through both satellites to the

ground terminal, where propagation times were measured; lines-of-position and fixes were computed. The 0.43 second tone-code ranging signal contained a single audio tone frequency. Ambiguity was resolved and user craft identified by a simple digital code. Seven vehicles were used in the test: three aircraft, two ships, an oceanographic buoy, and a truck. Ionospheric and multipath effects were studied. It is concluded that a VHF system could have an accuracy of + or - one nautical mile for ships and aircraft if calibration transponders are used to monitor the ionosphere. Author

N72-16512# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
ION PROPULSION FOR TELECOMMUNICATION SATELLITES STABILIZATION: RESEARCH AND DEVELOPMENT IN FRANCE
P. Luquet 1971 31 p refs Presented at the 11th DGLR European Space Symp., Berlin, 24-26 May 1971
Avail: NTIS

Research and development since 1968 on cesium engines for station keeping and attitude control of European communication satellites is reviewed. The following aspects are covered: thruster technology, automatic control and metrology, metallurgical research, electrostatic deflection of electron beams, emissive filament neutralization and the associated electronic equipment for thruster control and regulation. ESRO

N72-16513# Teleplan A.B., Solna (Sweden).
SOUNDING ROCKET RADIO TRACKING SYSTEMS DEVELOPED IN SWEDEN
J. Martin-Lof and P. Zetterquist 13 Sep. 1971 21 p refs Presented at the 2nd Brit. Interplanet. Soc. Symp. on Sounding Rockets and Exptl. Results, London, 15-16 Sep. 1971
(RTG-S-9-5; MTB2662-U05-209) Avail: NTIS

A description is given of hardware developed for sounding rocket tracking using subcarrier tone ranging for measuring slant range and an interferometer for angular measurement, both with digital output. The systems have been successfully used in Sweden during two campaigns in 1970. A measuring accuracy of better than approximately 100 meters in slant range and 0.1 degrees in angle was demonstrated. A computer program to determine the exospheric one trajectory was developed. A sound ranging system to complement radio tracking is described. ESRO

N72-16514# Eurospace, Paris (France).
THE USE OF SATELLITES FOR MARITIME PURPOSES EUROSPACE Memoranda No. 8
Jul. 1971 88 p refs
Avail: NTIS

The available information was surveyed, findings were critically assessed, and the feasibility of a maritime satellite system was concluded. Current procedures and future requirements are reviewed in navigation, communications, and safety aspects. Envisaged satellite systems and relevant organizations are considered. System studies, cost estimates, and benefits are also discussed. ESRO

N72-16515# Analytic Sciences Corp., Reading, Mass.
OPTIMAL STOCHASTIC GUIDANCE LAWS FOR TACTICAL MISSILES
Charles F. Price 1 Sep. 1971 112 p refs
(Contract N00014-69-C-0391)
(AD-731714; TR-170-2) Avail: NTIS CSCL 17/7

Guidance laws are developed for tactical missiles which take into account the following important dynamic and random effects: random target motion, homing sensor measurement noise, bounded control level, bounded acceleration level, and missile autopilot dynamics. Several different guidance laws are derived using optimal stochastic control theory and evaluated by computer simulation. An important conclusion of this work is that when intercept accuracy is appreciably limited by missile maneuvering capability, a control policy obtained by taking control saturation into account can yeild significantly better performance than control policies derived assuming that control levels are unconstrained. Author (GRA)

N72-16516# University of Southern Calif., Los Angeles. Dept. of Aerospace Engineering.
ESTIMATION THEORY BASIC TO NAVIGATION AND GUIDANCE SYSTEMS DESIGN Final Report, Sep. 1965 - Sep. 1971
Richard S. Bucy Oct. 1971 5 p refs
(Grant AF-AFOSR-1244-67; AF Proj. 9749)
(AD-732237; AFOSR-2729-71TR) Avail: NTIS CSCL 09/4

The report describes a five year basic research program in filtering or estimation theory. A publication list of 31 reports and technical reports are included. Author (GRA)

N72-16517# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
CONFIGURATION STUDIES FOR AUTONOMOUS SATELLITE NAVIGATION Progress Report, Jan. - May 1971
Ira A. Gura, Anthony S. Abbott, and Howard T. Hendrickson 28 May 1971 116 p refs
(Contract F04701-70-C-0059)
(AD-731679; TR-0059(6784)-1; SAMSO-TR-71-166) Avail: NTIS CSCL 17/7

Several autonomous satellite navigation configurations were studied on a common low-altitude basis with the emphasis on accuracy and convergence. Analysis was performed by simulation using recursive filtering techniques. Configurations investigated included horizon sensors, unknown landmark tracking, known landmark tracking, and one-way doppler systems. Relevant sensor combinations were analyzed to determine possible performance augmentation. Author (GRA)

N72-16518# Analytic Sciences Corp., Reading, Mass.
OMEGA UTILIZATION FOR NON-MILITARY SUBSCRIBERS, VOLUME 2
Joseph F. Kasper, Jr. 31 Dec. 1971 238 p refs
(Contract DOT-CG-94331-A)
(AD-731980; TASC-TR-192-2-VOL-2) Avail: NTIS CSCL 17/7

Analyses and computer programs developed in support of a study of non-military utilization of the OMEGA radio navigation system are presented. User operating procedures as well as accuracy estimates are considered in the study. The programs which are described in a comprehensive fashion utilize actual OMEGA phase data. Schemes for handling and editing the data as well as determining their error characteristics are described. The accuracies associated with several OMEGA configurations are evaluated using the data base. Subsequently, a computer simulation of navigation procedures required by the various configurations is outlined. It is in part based on the previously determined accuracy estimates. Accurate OMEGA navigation requires use of Skywave Corrections. Computer programs which determine the effectiveness of three different corrections models are described. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-16519*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 640 FOOT PER SECOND IMPACT TEST OF A TWO FOOT DIAMETER MODEL NUCLEAR REACTOR CONTAIN-

MENT SYSTEM WITHOUT FRACTURE
Richard L. Puthott [1971] 20 p refs
(NASA-TM-X-67997; E-6745) Avail: NTIS CSCL 18I

An impact test was conducted on an 1142 pound 2 foot diameter sphere model. The purpose of this test was to determine the feasibility of containing the fission products of a mobile reactor in an impact. The model simulated the reactor core, energy absorbing gamma shielding, neutron shielding and the containment vessel. It was impacted against an 18,000 pound reinforced concrete block. The model was significantly deformed and the concrete block demolished. No leaks were detected nor cracks observed in the model after impact. Author

N72-16520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF DASHPOT PERFORMANCE FOR ROTATING CONTROL DRUMS OF A LITHIUM COOLED FAST REACTOR CONCEPT
C. J. Wenzler Jan. 1972 25 p refs
(NASA-TM-X-67992; E-6734) Avail: NTIS CSCL 18I

A dashpot was incorporated in the design of the drive train of the rotating control drum to prevent shock damage to the control drum and drive train at the termination of a scram action. A rotating vane dashpot using reactor coolant lithium as a damping fluid appears to be the best candidate of the various damping devices explored. A performance analysis, results and discussion of vane type dashpots are presented. Author

N72-16521# Battelle-Northwest, Richland, Wash. Pacific Northwest Labs.
BNW PROGRAM NOISE
G. D. Seybold Jul. 1971 54 p refs
(Contract AT(45-1)-1830)
(BNWL-1609) Avail: NTIS

A computer code, NOISE, is presented which serves as an aid in determining reactor parameters from data obtained in zeropower reactor noise experiments. The code uses a nonlinear least-squares fitting package to provide the best estimate of these reactor parameters. Special options are available which allow for specification of the theoretical model, modifications of the experimental data in order to put them in units describable by the theory, and plotting features which illustrate the experimental measurements along with the best least-squares fit to the measurements. Author (NSA)

N72-16522# Oak Ridge National Lab., Tenn.
MORSE MONTE CARLO SHIELDING CALCULATIONS FOR THE ZIRCONIUM HYDRIDE REFERENCE REACTOR
C. E. Burgart 26 Aug. 1971 23 p refs Presented at the Symp. on Nat. and Manmade Radiation in Space, Las Vegas, Nev., 2-5 Mar. 1971 Sponsored by AEC
(ORNL-TM-3366; Conf-710304-13) Avail: NTIS

DOT-SPACETRAN transport calculations and MORSE Monte Carlo calculations of a lithium-hydride and tungsten shield for a SNAP reactor were compared. Transport of both neutrons and gamma rays was considered. Several forms of important sampling were utilized in the MORSE calculations. Quantities internal to the shield, as well as dose at several points outside of the configuration, were in satisfactory agreement with similar DOT calculations. Author (NSA)

N72-16523# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
PROCEEDINGS OF THE ROCKY FLATS SYMPOSIUM ON SAFETY IN PLUTONIUM HANDLING FACILITIES
Apr. 1971 463 p refs Conf. held at Golden, Colo., 13-16 Apr. 1971 Sponsored by AEC
(CONF-710401) Avail: NTIS HC $6.00/MF $0.95

The problems involved in the safe handling of plutonium isotopes in plant operation are discussed. Data are also given for (1) glovebox design and operation, (2) ventilation systems, (3) fire detection and suppression systems, and (4) environmental considerations. E.H.W.

N72-16524# Sandia Labs., Albuquerque, N.Mex. Reentry and Space Sciences Div.
THERMAL ANALYSIS OF THE INTACT SNAP-19/NIMBUS B/AGENA SYSTEM
R. D. Klett Jul. 1971 103 p refs Sponsored by AEC
(SC-RR-710353; UC-36) Avail: NTIS

The parametric safety studies conducted to aid in the design of the intact SNAP 19 radioisotopic thermoelectric generator and the final aerothermal safety assessment of the generator on the Nimbus B/SNAP-19 mission are presented. The safety analysis includes ablation and temperature predictions for a launch pad abort fire and for abort and orbital reentries. Author (NSA)

N72-16525# Oak Ridge National Lab., Tenn.
ORNL NUCLEAR SAFETY RESEARCH AND DEVELOPMENT PROGRAM Bimonthly Report, May - Jun. 1971
Wm. B. Cottrell Sep. 1971 112 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3483) Avail: NTIS

The accomplishments during the months of May and June in the research and development program on nuclear safety are summarized. Much of this work is in general support of water-cooled power reactor technology, including LOFT and industry programs, and reflects current safety problems, such as measurements of prompt fuel element failure phenomena and the problems associated with the long-term operation of containment spray systems. Several projects are also conducted in support of the high-temperature gas-cooled reactor and liquid-metal fast breeder reactor programs. Other major projects are those on primary piping and steel pressure-vessel technology. Author (NSA)

N72-16526# Oak Ridge National Lab., Tenn. Nuclear Safety Information Center.
COMPILATION OF NATIONAL AND INTERNATIONAL NUCLEAR STANDARDS (EXCLUDING US ACTIVITIES): INFORMATION GATHERED TO 31 DECEMBER 1970
Sep. 1971 129 p refs Supersedes ORNL-NSIC-78
(Contract W-7405-eng-26)
(ORNL-NSIC-94; ORNL-NSIC-78-Rev) Avail: NTIS

All known national and international nuclear standards activities are tabulated. Standards activities of all national organizations, technical societies and government agencies are listed alphabetically by country. Standards activities are included for: Australia, Austria, Belgium, Canada, Denmark, France, Germany, Hungary, India, Israel, Italy, Japan, Netherlands, Norway, Pakistan, Republic of South Africa, Sweden, United Kingdom, and Yugoslavia. International organizations activities include: Bureau Venitas, European Organization for Nuclear Research, European Atomic Energy Community, International Air Transport Association, IAEA, International Commission on Radiological Protection, International Commission on Radiation Units and Measurements, International Electrotechnical Commission, Intergovernmental Maritime Consulative Organization, International Organization for Standardization, Floyds, Organization for Economic Cooperation and Development, European Nuclear Energy Agency, and United Nations. 18 references. NSA

N72-16527# Addis Translations International, Woodside, Calif.
FRENCH AND SOVIET PAPERS PRESENTED AT THE SECOND PANEL ON THE PEACEFUL USES OF NUCLEAR EXPLOSIONS
Aug. 1971 116 p refs Transl. into ENGLISH from French and Russian papers Conf. held at Vienna, 18-22 Jan. 1971 Sponsored by AEC
(UCRL-Trans-10543; Conf-710108) Avail: NTIS

Contained nuclear explosions, for peaceful industrial purposes, are examined. Uses cover storage of liquid gaseous hydrocarbons, stimulation of oil fields, mineral extractions, and future use of gases formed by chemical reactions in rocks during such explosions. Data also cover the safety of such explosions and the use of them to stop runaway oil and gas wells. E.H.W.

N72-16528# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

RESEARCH ON CONTROLLED THERMONUCLEAR FUSION IN THE COMMISSARIAT A L'ENERGIE ATOMIQUE

M. Trocheris and G. Lidin (CEA, Limeil-Brevannes, France) Apr. 1971 16 p refs In FRENCH Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/813; Conf-710901-339) Avail: AEC Depository Libraries

Research work is summarized on controlled thermonuclear fusion in low densities associated with long confinement times and very high densities achieved during a very short time. The first approach consists essentially in studying plasma confinement in various magnetic configurations which may be open or closed. In the field of open configurations the results obtained from two experiments on confinement by static magnetic mirrors are reported. A brief account is also given of the experimental and theoretical results obtained so far on a concept of mixed confinement using both static magnetic mirrors and high-frequency plugs, and preliminary conclusions are presented on the possibility of using this concept in a thermonuclear reactor. In the field of closed configurations the theoretical work on equilibrium and stability of toroidal plasmas is summarized, together with the experimental results on the equilibrium of plasma rings of noncircular shape. The experiments on hard-core configurations are also briefly described. Author (NSA)

N72-16529# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

ORGANIZATION OF RESEARCH IN THE GRENOBLE NUCLEAR CENTRE IN CONJUNCTION WITH THE UNIVERSITY AND INDUSTRY

P. Balligand and M. Mitault Apr. 1971 12 p Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/638; Conf-710901-303) Avail: AEC Depository Libraries

The research teams include an important proportion of university scientists among whom several professors play the part of scientific advisers. There are more than 150 contracts with public or private organisms. Structures were and are being created to obtain a more efficient collaboration: the creation of the LETI, the presence of teams or laboratories from industry. The following fields are principally concerned: desalination, materials for electronics and metallurgy, low temperatures, irradiation devices. Author (NSA)

N72-16530# United Kingdom Atomic Energy Authority, Harwell (England).

USE OF RESEARCH REACTORS IN THE UNITED KINGDOM FOR NEUTRON BEAM STUDIES OF CONDENSED MATTER

G. G. Low and E. W. Mitchell (Reading Univ.) May 1971 8 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/486; Conf-710901-151) Avail: AEC Depository Libraries

The neutron beam experiments are: DIDO with two twin rotor time-of-flight spectrometers, one with a liquid hydrogen source, a 3-axis spectrometer and six 2-axis spectrometers for diffraction measurements; PLUTO with a twin rotor time-of-flight spectrometer, a 3-axis spectrometer, two polarized neutron spectrometers, three spectrometers for measurements of diffuse scattering (from, for example, defects) and three 2-axis spectrometers for diffraction; and HERALD with two instruments for defect studies, one with a liquid hydrogen-deuterium source, two 2-axis spectrometers for diffraction and two time-of-flight instruments, one also on the above cold source. A number of examples illustrating the range of recent experiments are given: among these are measurements of defect scattering at long wavelengths and studies of molecular energy levels by inelastic neutron scattering. Author (NSA)

N72-16531# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Reaktrofysik.

DEVELOPMENTS IN PULSED NEUTRON SOURCE STUDIES OF HETEROGENEOUS MODERATOR SYSTEMS

G. Grosshoeg and N. J. Sjoestrand May 1971 12 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/310; Conf-71091-269) Avail: AEC Depository Libraries

The conditions for obtaining discrete decay constants in pulsed source experiments on homogeneous and heterogeneous moderator systems are discussed. In heterogeneous systems, the neutron flight time in cavities and channels will cause a large influence of the continuum modes on the die away of the neutron population. The influence of the continuum can be varied through the introduction of absorbers in the body under study, and by complete elimination, the results from measurements on heterogeneous systems can be evaluated as in the classical pulsed method. A determination of the interaction parameter between two disks shows that the absorber method can be applied to problems of great practical importance. Author (NSA)

N72-16532# Liverpool Univ. (England).

UTILISATION OF BRITISH UNIVERSITY RESEARCH REACTORS

P.J. Duncton (Fairey Co., Ltd., Heston, Engl.), H. Bridge, J. Edwards (Roy. Naval Coll., Greenwich, Engl.), P. J. Grant (London Univ.), J. R. A. Lakey (Roy. Naval Coll, Greenwich, Engl.), W. K. Mansfield (London Univ.), and H. W. Wilson (Scottish Res. Reactor Centre, Glasgow) May 1971 11 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/485; Conf-710901-150) Avail: AEC Depository Libraries

British experience relating to the employment of university research reactors and subcritical assemblies in the education of nuclear scientists and technologists, in the training of reactor operators and for fundamental pure and applied research in this field is reviewed. The facilities available in a number of British universities and the uses which were made of them for undergraduate training and for postgraduate and postdoctoral research are described. Reference is made to the possibilities of work in collaboration with industrial, medical, and other nuclear establishments and laboratories. Statistics are given not only of the size of the various departments and of the influx of students, but also of the division of reactor operating time between the various types of work and classes of user. The nature and results of a typical range of research projects which were carried out in the university laboratories are described. Author (NSA)

N72-16533# State Committee for the Utilization of Atomic Energy, Moscow (USSR).

IBR-2 REACTOR, REACTIVITY PULSE DEVICE DESIGN AND ITS OPTIMIZATION

V. D. Ananjev, D. I. Blokhintsev, V. V. Bondarenko, Yu. M. Bulkin, E. N. Volkov, G. N. Zhemchuzhnikov, V. P. Zinovjev, B. I. Kuprin, V. S. Lobanov, A. K. Popov et al Jun. 1971 19 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971

(A/Conf-49/P/774; Conf-71091-426) Avail: AEC Depository Libraries

The pulsed fast reactor with injector is designed as a multipurpose unit for performing experiments in nuclear physics, solid state physics and several applied branches, using flight time spectrometry. The main requirement to the source of this type is to provide high neutron intensities on wide energy scale beginning from fractions of eV up to hundreds of keV with the pulse duration in the range from 1 to 100 msec. The most rational solution of this problem is to build a unit consisting of a pulsed fast reactor with high current electron accelerator-injector, the target of which is in the core of the reactor. The pulsing of the reactor is provided by periodical change of the system reactivity achieved by transference of the movable part of the reflector regarding the core. The results of neutron and physical

calculations of the reactor are given, as well as the justification for the reactor parameters from the point of view of physics, heat engineering, limitation in solidity and experimental requirements. Author (NSA)

N72-16534# Japan Atomic Energy Research Inst., Tokyo.
STUDIES ON RADIATION EFFECTS AT JAER
Takehiko Ishihara, Kiyoaki Taketani, Tatsuo Yatsurugi, Katsutoshi Watanabe, Naohiro Igata (Tokyo Univ., Japan), and Ryukiti R. Hasiguti (Tokyo Univ., Japan) May 1971 19 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/823; Conf-710901-345) Avail: AEC Depository Libraries

The studies on radiation effects of reactor fuels and structural materials have been conducted by mainly utilizing the reactors JRR-2, JRR-3, and JPDR in irradiation and hot laboratories at either Tokai or Oarai site in post-irradiation examinations. Several recent research projects by JAERI for fuel element materials and also the program in JMTR are introduced. The fundamental joint research for structural materials or pressure vessel steel by both University of Tokyo and JAERI is shown. The irradiation test for fuels was conducted by using the Experimental Fuel Test Loop-2 installed in JRR-2, Fission Gas Release Loop in JRR-3, and others. Author (NSA)

N72-16535# State Committee for the Utilization of Atomic Energy, Moscow (USSR).
CONTROLLED NUCLEAR FUSION Final Report
L. A. Artsimovich Aug. 1971 9 p Presented at 4th UN Intern. Conf. on the Peaceful. Uses of At. Energy, Geneva, 6 Sep. 1971.
(A/Conf-49/P/763) Avail: AEC Depository Libraries

A brief review of controlled thermonuclear research progress is given. Tokamak devices, magnetic mirrors, laser heating, and stellarators are discussed. NSA

N72-16536# United Kingdom Atomic Energy Authority, Culham (England).
PROGRESS ON RESEARCH TOWARDS A CONTROLLED THERMONUCLEAR REACTOR
R. S. Pease May 1971 15 p Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/488; Conf-710901-216) Avail: AEC Depository Libraries

Research on the problem of confining high-temperature plasma by magnetic fields is reviewed. Experimental and theoretical studies of confinement systems that might form the basis of future reactors (toroidal pinches, stellarators, and mirror machines) were made, together with experiments in simpler geometries to elucidate the principles of magnetic confinement. Plasmas with a wide range of density and temperature were confined for times ranging up to about 0.1 sec. Significant suppression of Bohm diffusion was observed. Confinement times (or cross-field diffusion coefficients) observed in a number of experiments, including those in stellarators, are close to those calculated for collisional diffusion alone. Author (NSA)

N72-16537# Central Research Inst. for Physics, Budapest (Hungary).
ROLE OF A RESEARCH REACTOR IN SCIENCE TECHNOLOGY AND EDUCATION IN HUNGARY
F. Szabo, Gy Csom, M. Oerdoegh, E. Szabo, and B. Vorsatz Jun. 1971 16 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/326; Conf-710901-274) Avail: AEC Depository Libraries

The range of influences exerted by a research reactor on the development of basic research is discussed. The provision of a research reactor was instrumental in initiating research in the fields of nuclear chemistry and reactor physics and hastened the development of the nuclear physics and electronics research. The devices and methods originally developed in the fields of reactor physics and nuclear physics coupled with the nuclear chemical know-how were rapidly brought into an applied research program and were successfully adapted into the production of semi-conductors, steel-making and the refining of nonferrous metals. The financing of the different stages of this program is also given. The experiences gained at the Institute's research reactor in helping the design of a reactor construction suitable for the intended educational and research program are reviewed. Since it must fulfill the needs of several universities, the characteristic feature of this reactor is that it has to support a complex educational program as well as ensure wider research possibilities. Author (NSA)

N72-16538# Institutt for Atomenergi, Kjeller (Norway).
MULTILEVEL DATA-BASED COMPUTER CODE SYSTEM FOR IN-CORE FUEL MANAGEMENT IN LIGHT WATER REACTORS
T. O. Sauar, S. Boerresen, J. Haugen, E. Nitteberg, H. K. Naess, and T. Skardhamar May 1971 18 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/293; Conf-710901-197) Avail: AEC Depository Libraries

Utility requirements for in-house fuel management capabilities are met by providing an automated multilevel computational system which is tailored to the characteristics of LWR cores and their fuel cycles. Adequate treatment of important nuclear and thermodynamic effects is ensured in integrated computer codes at various levels of calculational sophistication. Emphasis has been placed on automation by the use of a common data base for transfer of data between codes and easy access to previous data. Author (NSA)

N72-16539# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
TOKAMAK WITH SUPERPOSED MULTIPOLE MAGNETIC FIELD
W. Feneberg Jun. 1971 7 p refs
(IPP-III-2) Avail: AEC Depository Libraries

It is proposed that multipole magnetic fields be superposed on the Tokamak to produce an equilibrium such that the plasma is separated from the wall by a magnetic separatrix. The equilibrium is calculated for a special configuration with four conductors in which small deviations from circular symmetry are assumed. Author (NSA)

N72-16540# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
TRACE: FUEL CYCLE COMPUTER CODE FOR FAST REACTOR ANALYSIS
G. Graziani Aug. 1971 34 p refs
(EUR-4709-E) Avail: AEC Depository Libraries

A two-dimensional computer program is described which was written for the IBM 360/65. The program calculates the fuel input requirements and the neutron physics behavior of the equilibrium fuel cycle of a fast reactor, using a partial refuelling scheme. Author (NSA)

N72-16541# Oak Ridge National Lab., Tenn.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 31 Mar. 1971
P. Patriarca Jul. 1971 255 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3416) Avail: NTIS

In the eddy current instrument development for flaw identification, the two frequency oscillator and power amplifier module were completed, and eleven tuned amplifiers covering a frequency range from 1 kHz to 2 MHz were constructed. Computer programs were written for determining both magnitude and phase of impedance for a reflection coil above single and multiple layers of conductors. The ALCO/BLH steam generator is

being destructively examined to determine the causes of cracking in the lower tube sheet. An examination of the relations between defect size and stress-rupture properties of cladding is continuing. The mechanical properties, both creep-rupture and tensile, of submerged-arc welds in stainless steel are being determined. Welds on low carbon, low alloy steels are being studied. Research progress in cladding materials for space isotopic heat sources, advanced materials for steam generators, tungsten metallurgy, sodium corrosion, and nuclear fuel developments are also presented. J.A.M.

N72-16542# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Progress Report, period ending 31 Dec. 1971
P. Patriarca, comp. and D. J. Rucker, ed. Jul. 1971 351 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3300) Avail: NTIS HC $6.00/MF $0.95

The variations in electromagnetic induction caused by several second-order effects were analyzed to improve the accuracy of impedance measurements; components were designed and assembled for the eddy current instrument to measure both size and depth of weld flaws. Sodium corrosion studies are presented, including sodium removal and caustic effects. Weld specimens of alloys for use in steam generators exposed 16,000 hr in superheated steam at 595 and 650 C were evaluated. Uranium mononitride fuels, advanced FBR fuels, FBR neutron absorber materials, fuel element fabrication, and FBR oxide fuels were developed. Mechanical properties of alloys in reactor environments and LMFBR cladding and structural materials are described, along with physical and mechanical metallurgy of refractory alloys. Fast neutron irradiation effects on electrical insulators, tungsten metallurgy, cladding materials for space isotopic heat sources, irradiation damage to aluminum and aluminum alloys, and ferritic steel weld properties are also investigated. J.A.M.

N72-16543# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NUCLEAR THERMAL STUDIES IN FRANCE AND THEIR APPLICATIONS TO OTHER FIELDS
Henri Mondin 1971 16 p refs In FRENCH Presented at 16th Nucl. Congr., Rome, 25-26 Mar. 1971
(CEA-Conf-1758; Conf-710317-2) Avail: AEC Depository Libraries

The principal heat transfer studies made in relation with the French nuclear program are outlined and the results obtained are given. The information acquired is enumerated. Nonnuclear applications are classified by the nature of the applied information and the needs of the users. An important role is played by the fundamental aspects and the scientific potential and technology acquired by the teams studying thermal techniques in making use of new concepts. The liaison with the CEA and the nonnuclear industry with regards to reciprocal information, financing of contracts, and the interchange of knowledge, is discussed. Author (NSA)

N72-16544# United Kingdom Atomic Energy Authority, Harwell (England).
ISOTOPE POWERED THERMO-ELECTRIC GENERATORS
J. Myatt, A. W. Penn, and M. J. Poole May 1971 11 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/487; Conf-71091-152) Avail: AEC Depository Libraries

The research carried out at the Atomic Energy Research Establishment since 1962 on isotope powered thermoelectric generators is reviewed. The generators are of two main types, Pu-238 fueled and Sr-90 fueled. Research into the properties of heavily doped semiconductors, in particular bismuth telluride and germanium silicon alloys, and into junction materials is described. The properties of microporous silicate insulators, which have a thermal conductivity at room temperature lower than that of still air, are given. The design, construction, experimental testing; and performance of a range of strontium-90 titanate-powered terrestrial generators are described. The design options, configuration, biological shield, heat-to-electric and voltage conversion are discussed, as well as factors, such as radiation damage, which affect reliability. The installation and results from five field trials of generators allied to marine lights and navigation beacons are described. The general principles involved in the design and construction of miniature Pu-238 fueled 500 milliwatt (e) generators are presented. Author (NSA)

N72-16545# Argonne National Lab., Ill.
EBR-2 NOISE-SIGNATURE ANALYSIS DURING THE FIRST HALF OF FISCAL YEAR 1971. EBR-2 PROJECT
C. C. Price and J. R. Karvinen Feb. 1971 58 p refs
(Contract W-31-109-Eng-38)
(ANL/EBR-36) Avail: NTIS

The noise signature analysis done to data (February 1971) on EBR-2 and its auxiliary systems is presented. This effort began with a search for the source of the 10-Hz noise present in the ion chamber signals. The search provided a signature of primary sodium pump No. 1 which could be compared with the signature after an apparent binding of the pump. The comparison indicated more eccentric rotation of the pump after the apparent binding. The cause was apparently failure of the lower labyrinth seal. On November 4, 1970, an unusual noise was discovered emanating from the intermediate heat exchanger (IHX). A signature obtained on the secondary sodium outlet pipe of the IHX on August 21, 1970, had not shown any unusual noise present. Further signature analysis work, described with preliminary results, helped identify the cause of the noise. Author (NSA)

N72-16546# Argonne National Lab., Ill.
OPERATION OF EBR-2 AS AN IRRADIATION FACILITY AT 62.5 MWt: AN EVALUATION OF PLANT AND REACTOR DATA FROM RUN 46A. EBR-2 PROJECT
Feb. 1971 42 p refs Prepared in cooperation with Argonne Natl. Lab., Idaho Falls, Idaho
(ANL/EBR-37) Avail: NTIS

The initial operation of EBR-2 at 62.5 MW(t) occurred during run 38A in September 1969, with a core containing no fueled experimental subassemblies. Run 38A indicated that the reactor and plant were capable of sustained operation at 62.5 MW(t). After interim operation at 50 MW(t), during which minor adjustments were made to the plant and experimenters were informed of the plan to operate continually at 62.5 MW(t), run 46A was scheduled as the first to contain fueled experimental subassemblies and operate routinely at the higher power level. Experimental subassemblies were modified and relocated as required to match the higher-power conditions, and run 46A was begun. The reactor and plant were monitored during the run, and several special tests were carried out. As a result of the tests, the recommendation is made to continue operation of EBR-2 at 62.5 MW(t). Author (NSA)

N72-16547# Los Alamos Scientific Lab., N.Mex.
NUCLEAR SAFEGUARDS RESEARCH AND DEVELOPMENT Program Status Report, Jan. - Apr. 1971
May 1971 35 p refs
(Contract W-7405-eng-36)
(LA-4705) Avail: NTIS

The status of research on nuclear materials safeguards is reported. Information is included on: neutron interrogation and nondestructive assay of fissionable materials; radioisotope sources for nondestructive assay uses; passive neutron and gamma-ray assay applications; detector and instrumentation development; analytical studies and computational methods; and the Mobile Non-destructive Assay Laboratory. NSA

N72-16548# Mound Lab., Miamisburg, Ohio.
EXAMINATION OF SNAP-27 HEAT SOURCE FCA4 AND PREPARATION OF FUEL FOR FCA8

D. L. Prosser 23 Jul. 1971 51 p refs
(Contract AT(33-1)GEN-53)
(MLM-1831) Avail: NTIS

The capsule and fuel of SNAP-27 fuel capsule assembly (FCA)4 were examined for changes which may have occurred during its life of 2.25 yr. No significant effects were noted. The fuel was reprocessed and qualified for use in SNAP-27 FCA8.
Author (NSA)

N72-16549# Atomic Energy Commission, Washington, D.C. Div. of Peaceful Nuclear Explosives.
A SELECTED, ANNOTATED BIBLIOGRAPHY OF THE CIVIL, INDUSTRIAL, AND SCIENTIFIC USES FOR NUCLEAR EXPLOSIONS
Robert G. West and Robert C. Kelly, comps. (AEC, Oak Ridge, Tenn.) Sep. 1971 359 p refs
(TID-3522-Rev-9) Avail: NTIS

The bibliography contains 1594 annotated references to reports and published literature on the USAEC's Plowshare program. The references are arranged by subject category. Report number and availability, author, experiment, and foreign literature indexes are included. Author (NSA)

N72-16550# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
FORMULATION AND APPLICATION OF ANALYTIC REPRESENTATIONS OF FAST REACTOR FLUX AND IMPORTANCE SPECTRA
Floyd E. Dunn and Martin Becker 1971 79 p refs
(Contract AT(30-3)-328)
(RPI-328-189) Avail: NTIS

A model is developed for the study of fast reactor flux and importance spectra. The model is based on slowing down theories of the continuous slowing down type with suitable modifications introduced where such theories are deficient. The ability to obtain analytic solution for the flux and importance spectra depends on the ability to fit basic cross section ratios (such as the moderating ratio) to simple analytic forms. The cross section fits are used to obtain an expression for the slowing down density, which generally is a smooth function. Detailed cross sections, however, are used to relate flux and importance to slowing down density. The model yields good agreement with multigroup spectra on both broad group and ultra-fine group bases and yields quite accurate values for integral parameters (e.g., criticality and reaction rates). In addition, it is found to be possible to get a good correlation of cross section fit parameters with composition. Author (NSA)

N72-16551# Gulf General Atomic, San Diego, Calif.
CONTROLLED THERMONUCLEAR RESEARCH PROGRAM
Progress Report
Tihiro Ohkawa 15 Sep. 1971 91 p refs
(Contract AT(04-3)-167)
(Gulf-GA-A-10807) Avail: NTIS

The discussion of the dc multipole is divided into 5 subsections: (1) review of the device and its performance characteristics, (2) classical diffusion at high densities, (3) loss mechanisms at low densities, (4) design criteria and construction of the new toroidal winding, and (5) preliminary experiments with combined poloidal and toroidal magnetic fields. Research on Doublet II is discussed in four subsections: (1) vacuum system, (2) the field shaper, (3) the E-coil system, and (4) the B-coil system. NSA

N72-16552# Hanford Engineering Development Lab., Richland, Wash.
MECHANICAL PROPERTIES OF FAST REACTOR IRRADIATED AUSTENITIC STAINLESS STEEL WELDMENT MATERIALS
A. L. Ward, L. D. Blackburn, and A. J. Lovell 1971 5 p refs Presented at the Joint Meeting of the Am. Nucl. Soc., Miami, 17-21 Oct. 1971
(HEDL-SA-196; CONF-711009-4) Avail: NTIS

Pre- and postirradiation mechanical property results were obtained on specimens taken from weldments representing four weld processes and three filler metals: submerged-arc, Type 308; shielded metal-arc, 16-8-2 (Cr-Ni-Mo); gas tungsten-arc, Type 308; and gas metal-arc, Type 308L. All welds were made in one inch thick Type 304 plate and contained from 3 to 10 percent (by volume) delta-ferrite. No strong difference is noted in the rupture life behavior between Type 304 base metal and weld metal in either the irradiated or unirradiated conditions. While there are variations in degree among the various weld processes, there is a consistent trend toward reductions in rupture life due to irradiation. The primary contributor to losses in rupture life is reduced ductility since both the Type 304 base metal and the weld metal as a class showed no consistent tendency to increased creep rates. The submerged-arc and the gas metal-arc weldments showed smaller reductions in rupture life.
Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-16553# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
VALIDITY OF THE INFINITE MOMENTUM FRAME CANONICAL FORMALISM FOR SIMPLE LOOP DIAGRAMS
C. Bouchiat, P. Fayet, and N. Sourlas Oct. 1971 13 p refs
(LPTHE-71/53) Avail: NTIS

High energy approximations for electromagnetic processes and derivation of the parton model by two different methods are discussed. These methods can be used to obtain a perturbative expansion which exhibits the underlying Galilean structure of the field theory in the infinite momentum frame. It is shown that the Bjorken-Kogut-Soper infinite momentum formalism, applied to a properly regularized field theory, leads to the same answer as the covariant formalism, even when loops are present. It seems likely that this result holds true to an arbitrary order in the coupling constant for any normalizable field theory. K.P.D.

N72-16554# Sandia Labs., Albuquerque, N.Mex.
METHOD FOR THE ROUTINE MEASUREMENT OF DIELECTRIC PHOTOCONDUCTIVITY
W. H. Sullivan and R. L. Ewing 1971 32 p refs Presented at Ann. Conf. on Nucl. and Space Radiation Effects, Durham, N. H., 20 Jul. 1971 Sponsored by AEC
(SC-DC-713696; Conf-710709-3) Avail: NTIS

An instrumentation and data-reduction technique for the routine analysis of dielectric photoconductivity data was developed. This technique provides detailed results for conductivity versus time during and shortly after an ionizing radiation pulse. This technique was used to measure the peak conductivity of H-film and Teflon at dose rates greater than ten to the 11th power rads per second. The results of these experiments and details of the analysis technique used are described. NSA

N72-16555# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
EXPERIMENTAL DETERMINATION OF THE BASIC CHARACTERISTICS OF SPATIALLY PERIODIC MAGNETIC CONFIGURATIONS
Yu. M. Loktionov, V. P. Sebko, and V. I. Tyupa 1970 17 p refs In RUSSIAN
(KHFTI-70/49) Avail: AEC Depositories Libraries

Specific features of magnetic configurations with a spatial magnetic axis of the heliotron, heliotorse, and axisymmetric

stellarator type frequently make it impossible, in investigating magnetic fields with the aid of electron beams, to use mechanically a method applied for systems with a plane magnetic axis. A modification of this method is given here that makes it possible to investigate experimentally a number of important characteristics of configurations having a helical magnetic axis. The structures of magnetic surfaces, the position of spatial magnetic axes, the angles of rotational transformation, and the widths in a single-setting heliotron and a two-setting heliotorse, used here as examples, were studied experimentally. NSA

N72-16556# Chalmers Univ. of Technology, Goteborg (Sweden). Inst. for Teoretisk Fysik.
INSTITUTE OF THEORETICAL PHYSICS ANNUAL REPORT, 1970
1970 56 p refs
(NP-18997) Avail: AEC Depository Libraries

A summary is given of the current research projects at the institute of Theoretical Physics in Gothenburg. Research on elementary particle physics, transport properties in anharmonic crystals, correlation effects in liquids and in ferromagnets, electronic structure of metals and mechanics of vibrations and fluid dynamics are described. A list of publications is included. NSA

N72-16557# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
ESTIMATION OF FRICTION FACTOR OF ROUGH SURFACES FROM THE PRESSURE DISTRIBUTION AROUND A ROUGHNESS ELEMENT
S. C. Kacker Apr. 1971 25 p refs
(RD/B/N-1967) Avail: AEC Depository Libraries

A method for estimating the friction factor of rough surfaces from pressure measurements around a roughness element is described. The present method is suitable for developing boundary layers over rough surfaces, and it can be applied to study the effect of roughness element geometry and shapes on drag coefficients. Author (NSA)

N72-16558# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
GAMANL: A COMPUTER PROGRAM APPLYING FOURIER TRANSFORMS TO THE ANALYSIS OF GAMMA SPECTRAL DATA
T. Harper, G. T. Inouye, and N. C. Rasmussen Aug. 1968 87 p refs
(Contract AT(30-1)-3944)
(MIT-3944-2; MITNE-97) Avail: NTIS

GAMANL, a computer code for automatically identifying the peaks in a complex spectrum and determining their centers and areas, is described. The principal feature of the method is a data smoothing technique employing Fourier transforms. The smoothing eliminates most of the random fluctuations without affecting the spectral resolution, and makes identification of maxima using a zero slope criterion possible. If the same Fourier transform is used with different constants, it is possible with a second transformation to improve the spectral resolution. The computer program is written in FORTRAN IV for the IBM 360/65 computer and GE 635 computer. The complete analysis of a 4096-channel spectum containing one hundred twenty peaks requires about 75 seconds of computation time. Author (NSA)

N72-16559# Southampton Univ. (England).
ACOUSTICALLY INDUCED VIBRATIONS OF SLENDER RODS IN A CYLINDRICAL DUCT Ph.D. Thesis
Michael John Hine Jan. 1971 185 p refs Sponsored by Atomic Energy Authority
(TRG-2141(S/X); UDC-534.1) Avail: AEC Depository Libraries

The nature of acoustically-induced transverse vibrations of slender rods contained within a fluid-filled cylindrical duct was investigated for both single rods and rod clusters. The effect of low Mach number fluid flow on acoustically-induced rod response was also studied. NSA

N72-16560# Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris. Lab. Central de Recherches.
CHARACTERIZATION AND EVALUATION STUDY OF POSSIBILITIES FOR USE OF ORTHOFERRITES
M. BiedCharreton 17 Dec. 1970 23 p refs In FRENCH Sponsored by Deleg. Gen. a la Rech. Sci. et Tech.
(LCR-DR-1-70-192/1/R) Avail: NTIS

Properties of holmium orthoferrites are discussed. Amoung the topics considered are the stability conditions of magnetic bubbles as a function of the applied magnetic field, correlation between crystal lattice properties (form and surface finishing) with magnetic type, temperature effect on measured parameters, Faraday absorption and notation, and measurement of bubble mobility in relation to field structure. A shift register model is proposed. ESRO

N72-16561# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTAL PROBLEMS OF HIGH VOLTAGES IN THE FIELDS OF POWER ENGINEERING, ELECTRICAL ENGINEERING AND ELECTROPHYSICS
M. V. Kostenko 24 Aug. 1971 38 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (USSR), no. 2, 1965 p 12-31
(Contract F33657-71-D-0057; FTD Proj. 7JJ; DIA-Task-T66-01-08)
(AD-731909; FTD-HC-23-730-71) Avail: NTIS CSCL 09/3

A detailed survey was made of those scientific and engineering problems in the field of high-voltage technology which the author feels should be studied and possibly solved within the 1966-1970 period. It covers the entire field from electrophysical processes in solid, liquid, and gaseous dielectrics, through electromagnetic effects and the high voltage problems in the field of physical equipment, to the problem of high voltages in power and electrical engineering. Author (GRA)

N72-16562# Office of Naval Research, London (England).
THE INSTITUTE OF THEORETICAL PHYSICS, UNIVERSITY OF WARSAW, POLAND
Alfredo Banos, Jr. 26 Aug. 1971 14 p refs
(AD-731366; ONRL-R-37-71) Avail: NTIS CSCL 20/10

The report gives an account of a recent two-day visit to the Institute of Theoretical Physics of the University of Warsaw, Poland. The author concentrated mostly on the work of the Institute of Theoretical Physics, which today still bears the imprint and scientific legacy of the great Polish physicist Leopold Infeld (d. 1968), and particularly on the work of his former student and later valued collaborator, Prof. Jerzy Plebanski, Prorector of the University in charge of research, who was our host, and who is now internationally known for his work on general relativity, theory of gravitation, quantum electrodynamics, nonlinear electrodynamics, and allied topics. The author also gives an account of the Special Seminar which the author was invited to give on a class of one-dimensional wave propagation problems in inhomogeneous plasmas, and on the favorable comments that this occasion elicited. Author (GRA)

N72-16563# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DETERMINATION OF THE MAGNETIC FIELD AROUND A CURVED CONDUCTOR WITH ARBITRARY CURRENT DENSITY DISTRIBUTION
Herbert O. Schrade Jun. 1971 112 p refs
(AF Proj. 7063)
(AD-732214; ARL-71-0107) Avail: NTIS CSCL 20/3

The paper presents an analytical method to determine the magnetic field around any circular cross section of a current carrying, curved conductor. The current density distribution over any cross sectional area is represented by a Fourier series which

allows one to consider nonrotational distributions up to second order terms. By including the influence of the local channel curvature, the total magnetic field around such a conductor is expressed by the sum of short and far range fields. By means of this approach, one is able to relate the local conductor curvature and the current density distribution to the local, aximuthal magnetic field distribution and vice versa. The knowledge of this relation is important for determining static and dynamic effects on electrical, especially gaseous conductors. Author (GRA)

N72-16564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ELECTRICAL BREAKDOWN AND STRENGTHENING OF DIELECTRICS
I. G. Nekrashevich and I. A. Bakuto 25 Aug. 1971 15 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. (Minsk), v. 12, no. 2, 1968 p 126-130
(DIA-Task-T66-01-08)
(AD-731901; FTD-MT-24-783-71) Avail: NTIS CSCL 20/3

The report theoretically examines the phenomena of the electrical breakdown and strengthening of dielectrics under the effect of an electric field with the simultaneous effect of nonelectric forces, which in some cases can contribute and in other cases hinder the breakdown of dielectrics. Author (GRA)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-16565 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECTIVE RADIUS OF AN ATOM OF METAL IN A MODEL OF SPHERES OF INTERACTION
E. S. Filippov 1971 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), v. 7, 1971 p 114-118
(NLL-M-21168-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The first ionization potential, the radius of a free atom, and the coordination numbers K for the formation of a crystal from free atoms, were determined by considering the maximum Coulomb energy of valence electrons with an ion radius and a range of possible energies satisfying the space between the radii of an atom and an ion. The effective radius was determined. It is shown that: (1) The difference between the ionization energies of an atom in a crystal and of a free atom is equal to the Fermi energy. (2) An atom at the center of a sphere with the effective radius will probably interact both with the closest K surrounding atoms and with the K atoms arranged radially relative to the center of the sphere. (3) When the energy of the valence electrons alters, an atom of metal acquires a number of discrete energy values: cohesion, self-diffusion, and melting. The energy of the metal is quantized. Author

N72-16566*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
Zr-92(d,p)Zr-93 AND Zr-92(d,t)Zr-91
N. Baron, C. L. Fink, P. R. Christensen, J. Nickels, and T. Torsteinsen [1972] 18 p refs Presented at Am. Phys. Soc. Meeting, San Francisco, 31 Jan. - 4 Feb. 1972
(NASA-TM-X-67993; E-6738) Avail: NTIS CSCL 20H

The structures of Zr-93 and Zr-91 were studied by the stripping reaction Zr-92(d,p)Zr-93 and the pick-up reaction Zr-92(d,t)Zr-91 using 13 MeV incident deuterons. The reaction product particles were detected by counter telescope. Typical spectra from the reactions were analyzed by a nonlinear least squares peak fitting program which included a background search. Spin and parity assignments to observed excited levels were made by comparing experimental angular distributions with distorted wave Born approximation calculations. Author

N72-16567*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SCATTERING OF 42-MeV ALPHA PARTICLES FROM Cu-65
William M. Stewart and Kamal K. Seth (Northwestern Univ.) [1972] 11 p refs Presented at Am. Phys. Soc. Meeting, San Francisco, 31 Jan. - 3 Feb. 1972
(NASA-TM-X-68003; E-6771) Avail: NTIS CSCL 20H

The extended particle-core coupling model was used to predict the properties of low-lying levels of Cu-65. A 42-MeV alpha particle cyclotron beam was used for the experiment. The experiment included magnetic analysis of the incident beam and particle detection by lithium-drifted silicon semiconductors. Angular distributions were measured for 10 to 50 degrees in the center of mass system. Data was reduced by fitting the peaks with a skewed Gaussian function using a least squares computer program with a linear background search. The energy calibration of each system was done by pulsar, and the excitation energies are accurate to + or - 25 keV. The simple weak coupling model cannot account for the experimentally observed quantities of the low-lying levels of Cu-65. The extended particle-core calculation showed that the coupling is not weak and that considerable configuration mixing of the low-lying states results. K.P.D.

N72-16568# Montpellier Univ. (France). Lab. de Physique Matematique.
THE ASYMPTOTIC FORM OF THREE PARTICLE WAVE FUNCTIONS AND THE CROSS SECTIONS
Roger G. Newton [1971] 37 p refs Prepared in cooperation with Indiana Univ., Bloomington
(PM/71/9) Avail: NTIS

The asymptotic behavior of three particle wave functions in the coordinate representation is examined as all three particles move towards infinity. Both the wave function for a particle incident on a bound state, and that for three free incident particles are investigated. The results are expressed in terms of cross sections, and they lead to a clean separation of the double scattering terms from the true three particle scattering amplitude. The relevant reciprocity theorems from time reversal invariance are derived. Author

N72-16569# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
AN APPROXIMATION TO THE MASS DISTRIBUTION
J. L. Alonso and A. Galindo (Madrid Univ.) Nov. 1971 13 p refs Supported in part by GIFT, Spain
(LPTPE-71/52) Avail: NTIS

The available methods for computing phase space distributions for n-particle systems, such as Monte-Carlo methods, are found to be cumbersome when the number of particles n is too large. Even for low n (n approximately equal to 5), they need excessive computer time. Two recurrence expressions and an approximative formula are proposed to compute phase space mass distributions. Author

N72-16570*# Aerospace Corp., El Segundo, Calif.
THE IMPORTANCE OF POLARIZATION FOR ELECTRON SCATTERING IN THE INTERMEDIATE ENERGY REGION
Donald G. Truhlar 23 Feb. 1972 23 p refs Sponsored by NASA
(Contracts F040701-71-C-0172)
(NASA-CR-12553; AD-728205; SAMSO-TR-71-146; TR-0172(9260-01)-3) Avail: NTIS CSCL 20H

The angular dependence of electron scattering from the helium atom and the hydrogen molecule for small scattering angles in the 34 to 100 eV impact energy range is explained in terms of the first Born approximation and the polarized Born approximation. The theoretical results compare favorably with

the experimental data for both elastic and inelastic scattering.
Author

N72-16571# Montpellier Univ. (France). Dept. de Physique Mathematique.
THE INVERSE s-WAVE SCATTERING PROBLEM FOR A CLASS OF POTENTIALS DEPENDING ON ENERGY
M. Jaulent and C. Jean Oct. 1971 55 p refs
(PM/71/7) Avail: NTIS

The inverse scattering problem is considered for the radial s-wave Schroedinger equation with the energy dependent potential V(+)(E,x) = U(x) + 2(square root E) Q(x). This problem is closely related to the inverse problem for the radial s-wave Klein-Gordon equation of zero mass with a static potential. After introducing the potential V(-)(E,x) = U(x) - 2(square root E) Q(x) and the corresponding functions F(-)(x) and A(-)(x,t), fundamental integral equations are derived connecting F(+)(x), F(-)(x), A(=)(x,t), and A(-)(x,t) with two functions z(+)(x) and z(-)(x) and z(-)(x); z(+)(x) and z(-)(x) are themselves connected with the binding energies E(+)sub n and the scattering matrix S(+)(E), E > 0 (the input data of the inverse problem). The inverse problem is then reduced to the solution of these fundamental integral equations. Some specific examples are given. Author

N72-16572# Montpellier Univ. (France). Dept. of de Physique Mathematique.
NUCLEON-ANTINUCLEON ANNIHILATION AT REST AND HADRONIC PRODUCTION IN POSITRON ELECTRON ANNIHILATION AT 1.9 GeV
E. Pelaguier and F. M. Renard Nov. 1971 17 p refs
(PM/71/8) Avail: NTIS

The antinucleon nucleon annihilation at rest is analyzed with the help of a meson dominance model. The hadronic production coming from the 3 s state is then used for predicting corresponding production in positron electron annihilation at the same total energy. A comparison is made with the Frascati results and with those of other specific theoretical models.
Author

N72-16573# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ASYMMETRY OF THE MOST ENERGETIC NEUTRONS EMITTED AFTER MUON CAPTURE BY NUCLEI
C. Longuemare and C. A. Piketty Dec. 1971 8 p refs
(LPTHE-71/57) Avail: NTIS

The asymmetry of the most energetic neutrons emitted after muon capture by nuclei was calculated in a pure shell model to second-order nonrelativistic approximation. For closed shell nuclei this limiting value is independent of the model used and of the nucleus considered, except for a small kinematical dependence. Author

N72-16574# Laboratoire de Physique Theorique et Particules Elementaires, Orsay (France).
NEUTRAL MESON PHOTOPRODUCTION AND RELATED VECTOR MESON PRODUCTION
J. L. Alonso, L. Gislen, and J. TranThanhVan Dec. 1971 38 p refs
(LPTPE-71/56) Avail: NTIS

A study of neutral meson photoproduction and related vector meson production is made using the absorptive Regge cut model and constraints due to vector dominance model and SU(3). It is found that the nonsense wrong signature approach describes very well all the experimental data with a small number of parameters and does not suffer from the difficulties encountered by strong cut Reggeized absorption model. Author

N72-16575# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
ELECTRONIC POLARIZATION OF ATOMS IN CHARGED PARTICLE IMPACT
Kunizo Onda Oct. 1971 26 p refs
(IASA-471-Vol-36-13) Avail: NTIS

The dependence of the polarization of an atom in charged particle impact on the collision velocity is investigated by the impact parameter method. An effective polarization potential for the elastic scattering is proposed. It is confirmed that the induced dipole moment calculated by using the time dependent perturbed atomic wave function and that given by the dynamic dipole polarizability are equivalent. Author

N72-16576# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
LECTURES ON GROUP SYMMETRIES IN NUCLEAR STRUCTURE
J. C. Parikh 24 Jun. 1971 217 p refs
(Contract AT(30-1)-875)
(UR-875-350) Avail: NTIS

The lectures cover abstract group theory, group representations, representation theory and the summetric group, continuous groups and Lie groups, irreducible tensors, the unitary group and its subgroups, and spectral distribution methods. Also discussed are isospin distributions, the space symmetry group Wigner supermultiplet scheme, SU(3) symmetry and rotational features in light nuclei, and seniority and symplectic symmetry. NSA

N72-16577# Oak Ridge National Lab., Tenn.
SELECTED ABSTRACTS OF WORLD LITERATURE ON PRODUCTION AND INDUSTRIAL USES OF RADIOISOTOPES (FROM NSA, APRIL - JUNE 1971)
Martha Gerrard and P. S. Baker Sep. 1971 45 p refs
(ORNL-IIC-37-Pt-2) Avail: NTIS

Approximately 400 abstracts of domestic and foreign publications on production and use of radioisotopes and radiation, selected from the April-June 1971 issues of Nuclear Science Abstracts, are presented. Author (NSA)

N72-16578# Missouri Univ., Rolla. Space Sciences Research Center.
NUCLEAR RADIATION EFFECTS ON SILICON p-n JUNCTIONS Final Technical Progress Report, 1 Jun. 1966 - 31 May 1971
Charles A. Goben Jul. 1971 53 p refs
(Contract AT(11-1)-1624)
(COO-1624-41) Avail: NTIS

Experimental discoveries and theoretical developments clearly defined the role of the space charge region of a p-n junction in semiconductor device degradation. A rate of space charge volume damage introduction was defined, and its dependence on the neutron fluence and electric field of the junction (i.e., bias during irradiation) was determined. Equations that accurately predict the behavior of the p-n junction were developed. NSA

N72-16579# Los Alamos Scientific Lab., N.Mex.
SURFACE CONTAMINATION: DECISION LEVELS
J. W. Healy Sep. 1971 115 p refs
(Contract W-7405-eng-36)
(LA-4558) Avail: NTIS

Levels of contamination are derived for over 180 isotopes for the skin and clothing of workers and individuals in the general public as based on the National Council on Radiation Protection and Measurements (NCRP) recommendations on dose limitation. These levels consider the dose to the skin, the possible inhalation or ingestion of the deposited materials, and possible absorption through the skin. Estimates of the levels for transfer to the home are based on these mechanisms plus direct external radiation and resuspension using plausible transfer coefficients. The relation of these transfer levels to transfers to other areas is discussed. Readings on several of the more common types of instruments used to measure surface contamination are then derived. Appendices to provide background data on specific subjects include Appendix A, The Skin;

Appendix B, Beta Dose to The Skin; and Appendix C, Resuspension. All derived values for the decision levels for individual isotopes are given in Appendix D. Author (NSA)

N72-16580# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DIVISION OF ISOTOPES DEVELOPMENT PROGRAMS Quarterly Report, Feb. - Apr. 1971
J. E. Hansen, comp. Jun. 1971 51 p refs
(Contract AT(45-1)-1830)
(BNWL-1308-6; UC-23) Avail: NTIS

The results of the isotopic fuels program and related research are reported. The subjects studied included: encapsulation of fission-product Cs and Sr for process radiation sources; determination of the half-life of Rh-102; evaluation of potential radiological hazards from Pd-107; evaluation of large scale suses for purified fission product Xe; methods for stimulating a market for Cs-137 and Sr-90 sources; Pm-146 burnout; neutron radiography using Cf-252; preparation of alpha-photon sources; development of radioisotope-powered circulatory support systems; and evaluation of nuclear technique for seabed mineral exploration. NSA

N72-16581# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
SURVEY DOSIMETRY IN A FIELD OF 1200 CURIES OF GAMMA RAYS
G. Scarpa and M. Moscati 14 Apr. 1971 36 p refs In ITALIAN
(RT/PROT-(71)10) Avail: AEC Depository Libraries

Methods and results are described for a dosimetric study of the radiation field existing in the useful beam of a gamma irradiator. The unit was intended for radiobiological experiments and was equipped with a 1200 Ci Co-60 source. The measurements were carried out using a thimble-shaped, air-walled ionization chamber; the radiation field was searched in points distributed according to a space lattice pattern, with a 50 cm mesh. As a result, isoexposure curves were plotted and the beam limits were defined. Futhermore, the study allowed the source positioning inside the unit to be improved and the source shape and size to be directly visualized by means of a pin-hole camera technique. Author (NSA)

N72-16582# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Inst.
STUDY OF SENSITIVITY VARIATION OF NEUTRON COUNTERS IN VARIABLE GAMMA-FIELDS
V. V. Charychanskii, V. K. Bogatyrev, V. V. Frolov, V. I. Korolev, and V. V. Bondarenko 1970 18 p refs In RUSSIAN
(FEI-212) Avail: AEC Depository Libraries

A study is made of the sensitivity variation of neutron counters in intense gamma fields. The effect of statistical addition of the neutron and gamma pulses on the sensitivity of the counters to neutrons is investigated in detail. The problem of the possibility of stabilizing the sensitivity of the counters in a variable gamma field is considered. NSA

N72-16583# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactors.
NEW TOOL IN PHYSICS OF ELEMENTARY PARTICLES
V. P. Sarantsev Apr. 1971 13 p In RUSSIAN Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6 Sep. 1971
(A/Conf-49/P-695; Conf-710901-497) Avail: AEC Depository Libraries

Modern works on ion acceleration and perspectives in the near future are discussed. On the basis of experiments set up in various institutes in the USSR, forecasts are given of the development of the methods using electron rings, the plasma method, and the high current electron beam method.
Author (NSA)

N72-16584# Commissariat a l'Energie Atomique, Saclay (France).
ELECTRON MICROPROBE ANALYSIS OF HIGHLY RADIOACTIVE MATERIALS
Jean Bazin, Madeleine Conte, Michel Perrot, and Annick VanCraeynest 1971 23 p refs In FRENCH Presented at 13th Euratom Hot Lab. Meeting, Juelich, W. Germany, 24 Jun. 1971
(CEA-CONF-1783; Conf-710618-1) Avail: AEC Depository Libraries

The analysis or determination in small volumes of the constituents or impurities in a metallic matrix or radioactive ceramics necessitated the reduction of the thickness of the samples; in this way they could be analyzed without modifying the microanalyzer. The method is fast but has certain limitations. A shielded electron microanalyzer was also developed. Samples with a maximum activity of about 10 Ci at 0.75 MeV were examined, the external radiation being less than 2.5 mRad/h. The elements that can be analyzed have atomic numbers ranging from Z = 5 to Z greater than 94. Metallographic preparation of the sample followed by an alpha, beta, gamma decontamination allows this apparatus to be used under conditions similar to those of a standard microprobe. NSA

N72-16585# Institut Fiziki Vysokikh Energii, Serpukhov (USSR).
SERPUKHOV PROTON ACCELERATOR AND PHYSICAL INVESTIGATIONS USING PARTICLE BEAMS WITH ENERGY UP TO 70 GeV
A. A. Logunov Jun. 1971 13 p Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/449; Conf-710901-385) Avail: AEC Depository Libraries

The operating parameters and capabilities of the Serpukhov Synchrotron are described, and the high energy research program is outlined. NSA

N72-16586# Rutherford High Energy Lab., Chilton (England).
EFFECT OF IONISING RADIATION ON SYNTHETIC RESINS AT VERY LOW TEMPERATURE. AN INITIAL STUDY
D. Evans, J. T. Morgan, and G. B. Stapleton May 1971 21 p refs
(RHEL/R-220) Avail: AEC Depository Libraries; HMSO 30p; PHI $1.35

Data are given for the effect of ionizing radiation on a number of plastic materials of potential value in the construction of superconducting magnets. The irradiation was performed in the main at liquid nitrogen temperature on flexural test specimens without replication. The results of flexural tests at room temperature conformed to the expected improvement in dose/degradation observed in other systems irradiated at low temperature. The effect of gas formation and consequent disruption of structure was also demonstrated. Author (NSA)

N72-16587# Junta de Energia Nuclear, Madrid (Spain).
USES OF ISOTOPES AND RADIATION IN THE APPLIED SCIENCES AND TECHNOLOGY IN SPAIN
Jun. 1971 20 p refs In SPANISH Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6 Sep. 1971
(A/Conf-49/P/727; Conf-710901-499) Avail: AEC Depository Libraries

The present industrial uses of conventional techniques like industrial gamma radiography, nucleonic equipment for thickness, density, moisture, and level determinations in Spain are covered. In the field of applied research the following uses were developed: wear studies in internal combustion engines with radioactive piston rings, radioactive static eliminators, nucleonic fuel gages in spacecraft, coating thickness measurement by means of X-ray fluorescence techniques, large flow determinations of water discharges using the radioisotopic total count and dilution methods, single-well technique applied to the study of underground water, use of radiation for the production of wood-plastic composites and the applications of activation analysis in Spain. In the field of development research, the use

of isotopic flow determination methods in hydroelectric power stations; the use of labeled sand to study the movement of sediments in beaches, the study of dam seepage with the use of radioactive tracers, and the determination of the mercury inventory in electrolytic cells. Author (NSA)

N72-16588# State Committee for the Utilization of Atomic Energy, Moscow (USSR).
METHOD OF ISOTOPE TRACERS AND ITS USE IN THE INDUSTRIAL PRODUCTION
P. L. Gruzin, J. F. Babikova, A. N. Nesmejanov, V. I. Postnikov, and V. M. Kotlov Jun. 1971 27 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6 Sep. 1971
(A/Conf-49/P/701; Conf-710901-479) Avail: AEC Depository Libraries

The development of isotope tracer methods is discussed including the activation method, nuclear and spectrometric method, and emission method. The use of isotope tracers in applied science and technology is considered as well as their use in industry. NSA

N72-16589# State Committee for the Utilization of Atomic Energy, Moscow (USSR).
INTERNATIONAL COOPERATION OF THE USSR IN THE FIELD OF PEACEFUL ATOMIC ENERGY UTILIZATION
G. S. Afonin, Yu. G. Balasanov, I. D. Morochov, B. A. Semenov, and I. I. Smolin Aug. 1971 28 p Prepared for 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P-743; Conf-710901-461) Avail: AEC Depository Libraries

The information on the bilateral and multilateral agreements concluded since the 3rd international conference as well as on the development of cooperation on their basis is given. The progress in the field of such traditional forms as exchange of visits of scientists, exchange of scientific and technical information, and participation in the work of international meetings is considered. The information on the USSR assistance in establishing scientific research centers and in preparing specialists for meeting the needs of nuclear science and industry of a number of countries is presented. The perspectives of international cooperation in the frame of the IAEA are given and the information on the contribution of Soviet scientists in the activity of international organizations is presented. Examples of organization and implementation of joint research and development projects carried out by Soviet and foreign scientific-research centers and specialists are presented. Author (NSA)

N72-16590# United Kingdom Atomic Energy Authority, Culcheth (England). Reactor Group.
INVESTIGATION OF THE EFFECTS OF NEUTRON IRRADIATION ON THE COARSENING KINETICS OF GAMMA PRIME PARTICLES ON A NICKEL BASED ALLOY
C. F. Bilsby and J. Standring 1971 15 p refs
(TRG-2113) Avail: AEC Depository Libraries

The coarsening rate of the gamma prime dispersion in Nimonic PE 16 was established for the temperature 600, 650, and 700 C. The increase in mean particle diameter with time at a given temperature is shown to follow the law d cubed-d sub zero cubed = kt where d sub zero is the mean particle diameter at the commencement of aging. K is characterized by an activation energy of 64.5 kcal/mole. The mean particle diameter in specimens irradiated in a neutron flux of about 10 to the 13th power n/cm sq sec (fission) for times up to 5000 hr in the temperature range 545 to 650 C can be accurately predicted from the thermal data, indicating that there is no enhancement of coarsening rate due to irradiation above 545 C. Specimens irradiated at 400 C under simular flux conditions showed damage in the form of dislocation loops. Associated with these loops were gamma prime particles of larger than average diameter. A theoretical treatment is developed to obtain an appreciation of the probable effect of flux level on irradiation-enhanced coarsening. Author (NSA)

N72-16591# Technische Hochschule Aachen (West Germany).
SEARCH FOR PARTICLES WITH PARTIAL CHARGE IN SHOWERS Physikalisches Inst. (III).
A. Boehm, W. Diemont, H. Faissner, H. G. Fasold, K. Krisor, K. Maull, Z. Sawaf, and H. Umbach Mar. 1971 15 p refs In GERMAN
(PITHA-48(1971)) Avail: AEC Depository Libraries

Cosmic ray showers were analyzed with a proportional counterhodoscope. During a measuring time of 327 hours, 78,600 showers were observed. These were studied for tracks of quarks with a charge of one-third of two electrons. For three energy ranges from 10 to the 13th power to 10 to the 16th power eV, the number of quarks/shower were as follows: 0.14, 0.19, and 44. The experiments seemed to indicate that quarks occur only in showers in excess of 10 to the 15th power eV. NSA

N72-16592# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
APPLICATION OF SMALL ANGLE X-RAY SCATTERING TO THE STUDY OF IRRADIATION PRODUCED DEFECTS
N. A. Waterman May 1971 20 p refs
(RD/B/N-1990) Avail: AEC Depository Libraries

The theoretical basis of the idea that X-ray small angle scattering may be used to study irradiation produced defects is presented, and experimental difficulties are explored. Data are given which enable the feasibility of any projected experiment to be assessed. Author (NSA)

N72-16593# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
FAST NEUTRON IRRADIATION INDUCED SWELLING OF METALS AND ALLOYS
L. Stals Dec. 1970 32 p refs
(BLG-457) Avail: AEC Depository Libraries

A literature study of the experimental data on the swelling behavior of metals and alloys as observed after fast neutron irradiation is presented. The experimental data show that pure metals and alloys behave similarly as far as swelling is concerned. The threshold dose for swelling is for most metals a few orders of magnitude lower than for alloys. The temperature dependence of the swelling, however, is comparable. Theory predicts that in Types 304 and 316 austenitic stainless steel the swelling should saturate at delta V/V approximately equal to 12%. There is also some experimental evidence for saturation below delta V/V approximately equal to 20%. Author (NSA)

N72-16594# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
MULTIPLY CHARGED ION SOURCE. DESIGN OF ELECTRON GYROMAGNETIC RESONANCE SOURCE
S. Bliman (Grenoble Univ., France) and R. Geller Jun. 1971 28 p refs In FRENCH
(EUR-CEA-FC-603) Avail: AEC Depository Libraries

The possibility of expanding the applications of Pleiade-type machines in order to obtain multiply-charged heavy ion beams was studied. After a general review on the way in which heavy ion strippers are obtained, collisions in Pleiade-type electron cyclotron resonance sources (ionization, recombination, charge exchange) are studied. The properties of this type of plasma are described and the simplest way in which it is obtained is discussed; the problems arising within the plasma as a result of the extraction of an intense ion beam, the problems of transporting this type of beam, and the methods of obtaining N (7 plus) from the ion conglomeration drawn away were studied. NSA

N72-16595# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
NEUTRON SOURCES AND APPLICATIONS
Apr. 1971 173 p refs Presented at the Am. Nucl. Soc., Natl. Topical Meeting, Augusta, Ga., 19-21 Apr. 1971

(Contract AT(07-2)-1)
(CONF-710402-Vol-3) Avail: NTIS

Applications of neutron sources, and of Cf-252 in particular, to chemical analysis in the fields of geology, mineral exploration, and industry are discussed. Neutron activation for geochemical analysis, quality control in explosives, industrial processes, steel composition analysis, well logging, ground water analysis, nuclear materials assaying, and nuclear reactor testing are considered. Gamma ray analysis of coal and neutron radiography are also mentioned. K.P.D.

N72-16596# Southern Interstate Nuclear Board, Atlanta, Ga.
CONFERENCE ON INNOVATIVE APPLICATIONS OF RADIATION
[1971] 86 p refs Conf. held at Dallas, 22-23 Apr. 1971
Pration with Texas Radiation Advisory Board and AEC
(CONF-710428) Avail: NTIS

Energy dispersion X-ray equipment in combination with radioactive isotope sources was used to analyze mining and milling samples for copper, iron, molybdenum, lead, zinc, and uranium. Sample types included solid materials, solutions, muds, and slurries. The purpose of the Rulison project is presented for determination of the technical and economic feasibility of employing nuclear stimulation for natural gas release from tight formations. Radioactive isotopes are applied to material pollutant analysis, material usage control for efficiency and economic operation, policing or monitoring the emission of the pollutant from the user plant, and a pollutant check in the environment. Radiation uses in agriculture are also reviewed. J.A.M.

N72-16597# United Kingdom Atomic Energy Authority, London (England).
INTERNATIONAL COOPERATION IN NUCLEAR PROJECTS AND EXCHANGE OF INFORMATION
D. E. H. Pierson May 1971 7 p Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P-511; Conf-710901-228) Avail: AEC Depository Libraries

International nuclear cooperation between European countries, particularly the United Kingdom, is discussed. Emphasis was placed on the United Kingdom's assistance in information transfer, training, and attachments. The commercial interests and their problems are also examined. It was concluded that European efforts must be more closely integrated to cut out wasteful duplications and create an industry strong enough to compete with other nuclear powers. E.H.W.

N72-16598# Atomic Energy of Canada, Ltd., Ottawa (Ontario).
APPLICATIONS OF ISOTOPES FOR INDUSTRIAL MEASUREMENTS AND CONTROL
R. W. Tolmie May 1971 13 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P/164; Conf-710901-181) Avail: AEC Depository Libraries

Several systems were designed to analyze minerals, ores, mill products, and other materials by X-ray emission or neutron activation. Portable (for x-ray analysis only), transportable, laboratory and on-line equipment was developed, based on Si and Ge detectors and programmed pulse-height analyzers. These can be combined with preconcentration methods to obtain very high sensitivities, and for air pollution measurements. Similar programmed analyzers with computer-compatible magnetic tape outputs are used for measuring naturally occuring K-40 and the daughter radioisotopes of uranium and thorium to locate uranium ore deposits and to assist in general geological studies. Radioisotopes are used as tracers in industrial processes. In environmental work, tracers are used to measure ground water movements, leakage from septic tanks, and evaporation from bodies of water. Radioisotopes are also utilized as sources of power for control and signal systems. The heat produced by the sources also ensures proper operation in frigid climates. Author (NSA)

N72-16599# Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (East Germany).
NUCLEAR SPECTROSCOPY WITH A DEUTERON BEAM
Manfred Bonitz Mar. 1969 81 p refs In GERMAN; ENGLISH summary
(ZFK-172) Avail: AEC Depository Libraries

The application of the two-dimensional technique to nuclear spectroscopic investigations of isomeric states produced with a deuteron beam is described. The pulsed beam technique and the associated particle method applied to protons from the (d,p) reaction were used. The following final nuclei were subject to investigations: Er-171, Yb-173, Er-169, Gd-159, Tm-170, Bi-208, Au-198, Cd-115, Sm-151, Gd-155, Tb-160, Gd-161, Dy-163, Dy-165, Er-167, Yb-171, Yb-175, natural Hf + n, natural W + n, and Bi-210. Five new isomeric states were found, and several isomeric decays were successfully cleared up and interpreted. In doubly odd nuclei the Omega selection rule was discovered, and first evidence for the j selection rule was found. Author (NSA)

N72-16600# Paris Univ., Orsay (France). Faculte de Sciences.
NILSSON HAMILTONIAN ON AN ASYMPTOTIC BASIS Ph.D. Thesis
Philippe Quentin 1970 51 p refs In FRENCH
(FRNC-TH-27) Avail: AEC Depository Libraries

A simple and exact method is proposed for resolving the problem of diagonalizing a Nilsson Hamiltonian. An asymptotic basis is introduced which is a powerful tool for the treatment of deformed nuclei. NSA

N72-16601# South Carolina Univ., Columbia. Dept. of Physics and Astronomy.
FEASIBILITY OF OBSERVING INVERSE BETA DECAY BY DIRECT COINCIDENCE TECHNIQUES Final Report
F. T. Avignone, III and C. W. Darden, III [1971] 37 p refs
(Contract AT(38-1)-474)
(SRO-474-2) Avail: NTIS

The investigation was a study to determine whether or not reactions can be identified by detecting only the two annihilation gamma rays from the subsequent reaction e(+) + e(-) yields 2 gamma, and the pulse in a target scintillator caused by the slowing of the positron. The results of the experiments indicate that such experiments are very probably feasible if performed inside a cosmic ray live shield. It is estimated, that approximately 80 to 100 per cent of the background events are in prompt coincidence with cosmic-ray muons entering into the shielded target region. This discovery was made using a partial cosmic ray live shield located on top of the lead-and boron-loaded polyethylene-shielded target region. Author (NSA)

N72-16602# California Univ., Berkeley. Lawrence Radiation Lab.
DROPLET MODEL
William D. Myers Jul. 1971 27 p refs
(Contract W-7405-Eng-48)
(LBL-209) Avail: NTIS

Some examples of the effectiveness of the liquid drop model are first considered, and then the ways in which this model and leptodermous approaches in general are related to other methods in many body theory are discussed. Next, the example of the Hill-Wheeler box is used to show that the leptodermous approach is applicable to quantum systems even with relatively small numbers of particles. The smooth part of the total energy is then separated from the shell effects, and it is clear that an A1/3 term must be included. After a brief introduction to the methods used to obtain the droplet model energy equation, a simplified version is used to display the most important new terms that enter. Finally, some applications of the theory are given, and it is pointed out that comparison with a

much wider range of phenomena is planned once the coefficients of the theory are better determined. Author (NSA)

N72-16603# Wisconsin Univ., Madison. Dept. of Physics.
EVALUATIONS OF RAMAN EFFECTS FOR DETECTING FAST NEUTRON INDUCED RADIATION DAMAGE, PART 1. ELECTRON SPIN RESONANCE MEASUREMENTS IN DOSIMETRY RESEARCH, PART 2
P. R. Moran ?ILLEGAL DATE? 4 p Sponsored by AEC
(COO-1105-168-Pt-1; COO-1105-168-Pt-2) Avail: NTIS

It is shown that relativistic limitations on present sample perfection and instrumentation exclude the Raman effect as a practical technique for low level dosimetry. For the alanine-based ESR dosimeter technique, experimental sensitivity is in agreement with the estimated detection level (about 10 rad) for fast neutrons. NSA

N72-16604# Australian Atomic Energy Commission, Coogee.
AUSTRALIAN ATOMIC ENERGY COMMISSION NINETEENTH ANNUAL REPORT, FOR YEAR ENDING 30 JUNE 1971
30 Jun. 1971 147 p refs
(NP-19036; AAEC-AR-1970-71) Avail: AEC Depository Libraries

Activities for the year ending 30 June are described. Summaries are given of the status of the Jervis Bay nuclear power station; uranium exploration activities in Australia; radioisotope development, production and distribution; research related to nuclear power and associated disciplines; and international matters. Nuclear power is also discussed in a more general sense with respect to management and regulation, the environment, and world wide developments. Publications by staff are listed. NSA

N72-16605# North Carolina State Univ., Raleigh. Dept. of Chemical Engineering.
RESEARCH AND DEVELOPEMENT STUDIES INTO THE BASIC TECHNOLOGY OF RADIATION INDUCED IONIC POLYMERIZATION INCLUDING SMALL SCALE PILOT PLANT SYSTEMS
V. Stannett, E. P. Stahel, J. Kohler, E. Oda, S. Omi, A. Goineau, H. P. Shah, and F. T. Osborne 1 Jun. 1971 120 p refs
(Contract AT(40-1)-3667)
(ORO-3667-1) Avail: NTIS

Studies were conducted in depth of the radiation-induced polymerization of vinyl monomers under superdry conditions. Basic laboratory studies and engineering pilot plant research were carried out. Results show that neither vinyl chloride nor molten or solutions of trioxane could be induced to polymerize ionically even after the most stringent drying; beta pinene was found to polymerize readily after drying; in a study of a series of alpha olefins analogous to isobutylene only isobutylene polymerized ionically; isobutyl vinyl ether was polymerized at the highest yields yet reported; and isopropyl vinyl ether was polymerized under optimum conditions for the first time with a square root dependence of the rate on the dose rate. A recirculating flow reactor system was used to study the radiation-induced polymerization of styrene and alpha-methylstyrene in bulk and solution. NSA

N72-16606# Scripps Institution of Oceanography, San Diego, Calif.
THE 1971 RESULTS FOR THE INTERCOMPARISON OF ANALYTICAL METHODS FOR Cs-137 AND Cs-134 USED AT SCRIPPS WITH METHODS USED AT 56 OTHER INSTITUTIONS
V. F. Hodge, T. R. Folsom, and N. Hansen 16 Mar. 1971 9 p refs
(Contract AT(04-3)-34)
(TID-25777) Avail: NTIS

The method for determining Cs-137 and Cs-134 in sea water is described. The cesium was precipitated by ammonium 12-molybdophosphate (AMP) and dried for gamma counting. The supernatants were then scavenged with ferric hydroxide, precipitated a second time by AMP, and dried for gamma counting. All AMP and ferric hydroxide precipitates were counted above a 5' x 4' sodium iodide scintillator crystal, using a conventional 200-channel analyzer. Since the samples were mixtures of Cs-137 and Cs-134, the 0.605 MeV peak of Cs-134 partially overlapped the area of Cs-137. The first AMP precipitates were counted again with a two-dimensional sodium iodide spectrometer. NSA

N72-16607# Western Environmental Research Lab., Las Vegas, Nev.
ENVIRONMENTAL SURVEILLANCE FOR PEWEE 1, EXPERIMENTAL PLANS 2 AND 3, 21 NOVEMBER AND 4 DECEMBER 1968 Final Report
Sep. 1971 33 p refs Sponsored by AEC
(SWRHL-87-r; Memo-SF-54-373) Avail: NTIS

Radiological monitoring and sampling were conducted in off-site areas after the testing of the Pewee 1 reactor. No radioactivity was released during plan 1. Following plan 2, airborne radioactivity was detected by aircraft, but was not detected off-site on the ground by thermoluminescent dosimeters (TLD's) and Geiger-Mueller (GM) survey instruments, or in air, vegetation and milk samples. The radioactive effluent from plan 3 was found by aircraft and off-site surveillance to have moved east-southeast from the test area as far as northwestern New Mexico. Low levels of I-131, Te-I-132 and I-133 were detected on natural vegetation and air samples. Air samples which contained reactor-related radioactivity were collected. Emissions from reactor pulse cool down operations and possibly portions of the main reactor cloud transported south by the evening drainage winds were also detected by air samplers. The maximum calculated thyroid dose from the inhalation of airborne radioiodine, based on air sampling results, occurred at Las Vegas, Nevada, where the postulated child thyroid dose was less than one mrad. Author(NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-16608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RANDOM WALK STUDY OF ELECTRON MOTION IN HELIUM IN CROSSED ELECTROMAGNETIC FIELDS
Gerald W. Englert Washington Feb. 1972 36 p refs
(NASA-TN-D-6648; E-6453) Avail: NTIS CSCL 20I

Random walk theory, previously adapted to electron motion in the presence of an electric field, is extended to include a transverse magnetic field. In principle, the random walk approach avoids mathematical complexity and concomitant simplifying assumptions and permits determination of energy distributions and transport coefficients within the accuracy of available collisional cross section data. Application is made to a weakly ionized helium gas. Time of relaxation of electron energy distribution, determined by the random walk, is described by simple expressions based on energy exchange between the electron and an effective electric field. The restrictive effect of the magnetic field on electron motion, which increases the required number of collisions per walk to reach a terminal steady state condition, as well as the effect of the magnetic field on electron transport coefficients and mean energy can be quite adequately described by expressions involving only the Hall parameter. Author

N72-16609# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
BEHAVIOUR OF A POSITIVE PROBE IN HIGH-SPEED

COLLISION-FREE PLASMA FLOW
Joseph Taillet, Andre Brunet, and Gerard Fournier 1971 14 p refs Presented at the IUTAM Conf. on Ionized Gas Dyn., Tokyo, 13-18 Sep. 1971
(ONERA-TP-1000) Avail: NTIS

It is shown, by numerical computation and by experimental investigation, that a positive body immersed in a mesothermal plasma flow is not surrounded by a sheath in the usual sense, and that the applied potential spreads out over a large distance compared to the Debye shielding radius. Application of this concept to satellite-borne electrodes and probes is suggested.
Author

N72-16610*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WAVE GROWTH IN A STRONGLY TURBULENT PLASMA
T. J. Birmingham and M. Bornatici Sep. 1971 19 p refs
(NASA-TM-X-65802; X-641-71-321) Avail: NTIS CSCL 20I

An equation is derived for the average nonlinear growth (damping) rate of an electrostatic mode with wave vector k for an ensemble of electrostatically turbulent, unmagnetized plasmas. Strong turbulence alters particle orbits during the course of wave growth and hence brings particles in and out of resonance with the wave. The wave growth rate in a strongly turbulent plasma therefore depends on the initial velocity distribution of particles not only at the wave speed, but in the vicinity of this speed as well. Two orbital effects are considered: turbulence modification of ensemble average orbits and turbulence-produced orbital dispersion about the average orbits. Both contribute to a resonance broadening.
Author

N72-16611# Atomic Energy Commission, Washington, D.C.
DETERMINATION OF THE BOUNDARY OF HIGH FREQUENCY WAVE ABSORPTION BETWEEN THE ELECTRON CYCLOTRON AND THE LOW HYBRID FREQUENCY
B. V. Galktinov, V. E. Golant, V. D. Dyachenko, and O. N. Shcherbinin Oct. 1971 7 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Leningrad. Fiz. Tekhn. Inst., rept. FTI-295
(AEC-TR-7270; FTI-295; DR-1947; TID-4500) Avail: NTIS

The boundary of the absorption of high frequency waves by plasma was determined from the study of conditions under which plasma was maintained by HF power. From the variation of plasma parameters, some critical values were found when the plasma density decreased abruptly. The results can be related to the theory of absorption by linear wave transformation.
Author (NSA)

N72-16612# Institut Atomnoi Energii, Moscow (USSR).
EXPERIMENTAL STUDY OF ION-CYCLOTRON INSTABILITIES OF A PLASMA PRODUCED BY A FAST ION BEAM
A. V. Bortnikov, N. N. Brevnov, V. G. Zhukovskii, and M. K. Romanovskii 1970 50 p refs In RUSSIAN
(IAE-2044) Avail: AEC Depository Libraries

Ion-cyclotron oscillations occurring in a low-density plasma after its capture in a trap with magnetic mirrors are investigated. It was established that the oscillations are caused by two different types of ion-cyclotron instabilities. The time and spectral characteristics of the instabilities are measured. The thresholds for the development, the wavelengths and increments of the developing oscillations were determined. It was found that the form of the velocity distribution function of the ions affects the development of the oscillations in a considerable way. The effect of a decrease in the longitudinal dimension of the plasma, certain nonlinear characteristics of the oscillations, and consequences to which the development of both instabilities lead are discussed. It is observed that the first instability leads to heating and the expulsion of electrons along the magnetic field and the expulsions of ions across the field. The second instability did not cause additional particle losses from the trap.
NSA

N72-16613# Uppsala Univ. (Sweden). Inst. of Physics.
SHELL STRUCTURE IN A PLASMA
Bo Kjellmert Nov. 1970 78 p refs
(UUIP-724) Avail: AEC Depository Libraries

Axially and azimuthally symmetric systems of charged particles in an external axial, homogeneous, magnetic field are studied. Stationary, self-consistent systems are constructed, in which the Lorentz force balances the centrifugal force. A comparison system is introduced in order to normalize expressions of angular momentum and energy. For simplicity, a thin layer of particles at rest is chosen as comparison system. This system is looked upon as an initial system from which the stationary system has developed. Especially, systems for which minimum energy is associated with the motion of the charged particles are considered. The number of particles and the angular momentum are assumed to be known constants. The plasma is supposed to be cold.
Author (NSA)

N72-16614# Nagoya Univ. (Japan). Inst. of Plasma Physics.
RADIAL MOTION OF PLASMA IN THETA PINCH
Ichiro Kawakami Dec. 1970 70 p In JAPANESE
(IPPJ-DT-23) Avail: AEC Depository Libraries

A manual is presented for the computer simulation of plasma moving in a radial direction that can be observed in theta or z pinches. It is assumed that the plasma is cylindrically symmetric, and has no dependence in z (axial) and Theta (azimuthal) directions. The plasma is compressed by magnetic fields produced by current flowing through an outer coil and, if necessary, by current flowing in a hard core. The program is constructed so that only the magnetic field by the outer coil acts when radius r sub c of the hard core is zero, and both fields by the currents in the hard core and the outer coil act when r sub c is not equal to 0. The plasma is composed of ion and electron fluids. Flow charts and the program itself written in FORTRAN 4 are presented.
NSA

N72-16615# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
ON THE EFFECT OF WAVE FIELD PRESSURE ON LONGITUDINAL OSCILLATIONS IN A PLASMA
V. V. Dolgopolov 1970 8 p refs In RUSSIAN
(KHFTI-70/58) Avail: AEC Depository Libraries

The effect of a high-frequency wave potential (the pressure of the electromagnetic wave field) on standing Langmuir monochromatic oscillations in a plasma is investigated. It is shown that the picture of field oscillations obtained, considering the high-frequency potential, is considerably different from the picture of oscillations obtained in the linear approximation even when the gas-kinetic pressure of the plasma is considerably greater than the electromagnetic field pressure. In particular, localized monochromatic standing waves are possible.
NSA

N72-16616# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
EFFECT OF HIGH-FREQUENCY POTENTIAL ON THE PROPAGATION OF FAST WAVES ALONG A MAGNETOACTIVE PLASMA LAYER
V. V. Demchenko, V. V. Dolgopolov, and A. Ya. Omelchenko 1970 11 p refs In RUSSIAN
(KHFTI-50/57) Avail: AEC Depository Libraries

The effect of the pressure of an electromagnetic wave field on the propagation of fast waves along a plane parallel layer of magnetoactive plasma was investigated. Expressions for the fields and dispersion equations in limiting cases when the high frequency potential is small or great in comparison with the plasma temperature were obtained. The dispersion equations are considerably different from the dispersion equations of linear theory. The plasma density distribution over the thickness of the layer was found. It is shown that a high frequency potential can ensure penetration into the plasma of an electromagnetic field which, in the linear approximation, does not penetrate the plasma due to skin effect.
NSA

N72-16617# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.

ON THE THEORY OF THE TRANSFORMATION OF SURFACE WAVES INTO LONGITUDINAL OSCILLATIONS IN THE SURFACE LAYER OF A PLASMA WAVE-GUIDE

V. V. Demchenko, V. V. Kolgopolov, and A. Ya. Omelchenko 1970 16 p refs In RUSSIAN

(KHFTI-70/55) Avail: AEC Depository Libraries

It is shown that surface waves caused by an initial perturbation in a homogeneous plasma cylinder are translated into longitudinal oscillations which are concentrated in the layer transitional between plasma and vacuum and are directed along the plasma density gradient along the radius of the cylinder. The translation occurs during a time interval determined by the width of the narrow transition region. NSA

N72-16618# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.

ON THE TRANSFORMATION OF ELECTROMAGNETIC WAVES INTO LONGITUDINAL OSCILLATIONS IN A NONHOMOGENEOUS PLASMA IN THE PRESENCE OF AN IDEALLY CONDUCTING SURFACE

V. V. Demchenko, V. V. Dolgopolov, and A. Ya. Omelchenko 1970 21 p refs In RUSSIAN

(KHFTI-70/54) Avail: AEC Depository Libraries

It is shown that electromagnetic waves caused by an initial perturbation at the boundary of a semi-infinite plasma are translated into longitudinal oscillations. The conditions include an ideally conducting surface and the time during which oscillation occurs is determined by the width of the transition region from plasma to vacuum. The oscillations are concentrated in the transition layer and are directed along the plasma density gradient. NSA

N72-16619# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.

STUDY OF THE TURBULENCE AND HEATING OF A PLASMA WITH A TRANSVERSE CURRENT

V. V. Demchenko, V. L. Sizonenko, and K. N. Stepanov 1970 19 p refs In RUSSIAN

(KHFTI 70-62) Avail: AEC Depository Libraries

The conditions of turbulent pulses of density, velocity of electrons and ions, and intensity of the electric field in a plasma were investigated when a current is flowing perpendicular to the magnetic field. Hydrodynamic cluster instability with a given frequency and increment of buildup develops. The cross section of combined scattering of microwaves by electron density pulses was evaluated, and a comparison was made with the experimental results. It was shown that, in such a plasma, there is an effective heating mechanism for the nonresonant ions associated with the final correlation time of electric field pulses. The increases in transverse ion temperature and longitudinal electron temperature were determined. Heating is contingent on the Larmor ion radius being less than the chamber radius. Author (NSA)

N72-16620# Academy of Sciences (USSR), Moscow. Physics Inst.

STUDY OF PLASMA CONTAINMENT IN TOR-1 STELLARATOR

D. K. Anulina, E. D. Andryukhina, Yu. I. Nechaev, O. I. Fedyanin, and Yu. V. Khol'nov Jun. 1971 27 p refs In RUSSIAN

(NP-18973) Avail: AEC Depository Libraries

The plasma was created by two methods: first by external injection from an arc source, and secondly, by ionization and heating by means of a very high frequency electromagnetic field. The structure of the magnetic field was investigated and found to be perfect. Hence it was possible to determine the plasma lifetime in a collision free regime over a large range of rotational transform angles. A linear increase in plasma lifetime is observed even at large transform angles. On obtaining a plasma by high frequency ionization it was found that there is an anomalous, nonresistive absorption of energy on interaction of the high frequency waves with the plasma. The anomalous absorption is accompanied by the appearance of a quasistationary constant current flowing through the plasma. The conditions of plasma creation significantly determine the behavior of the decaying plasma. Studies of the characteristics of containing a dense plasma showed that the containment time was of the same order of magnitude as would be expected from the theory of hydrodynamic equilibrium in toroidal systems. NSA

N72-16621# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

SATURATION AND DAMPING OF ECHOES OF ELECTRON PLASMA WAVES

M. Guillemot, J. Olivain, F. Perceval, A. Quemeneur, and G. Matthieussent (Paris Univ., Orsay, France) [1970] 3 p refs In FRENCH Presented at Phys. Conf., Evian, France, 25-29 May 1971

(CEA-CONF-1804; Conf-710527-4) Avail AEC Depository Libraries

When two strongly damped electron plasma waves are excited in two different points of a plasma, an electric field appears in a place where the mother waves have disappeared: this is the echo. Experimental results concerning the spatial behavior of the echo, the effect of Coulomb collisions, or the effect of an induced turbulence are in good agreement with theoretical predictions. NSA

N72-16622# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

INTERACTION OF A LARGE-AMPLITUDE WAVE WITH A PLASMA: TRAPPING

M. Guillemot, J. Olivain, F. Perceval, and A. Quemeneur [1969] 3 p refs In FRENCH; ENGLISH summary Presented at Phys. Conf., Evian, France, 25-29 May 1971

(CEA-Conf-1805; Conf-710527-5) Avail: AEC Depository Libraries

When an electron plasma wave propagates in a plasma, effects due to the trapping of particles in the potential well such as spatial oscillations of the wave and deformation of the distribution function appear. The experimental studies of the distribution function deformation are in good agreement with theoretical predictions obtained by solving exactly the Vlasov equation. Author (NSA)

N72-16623# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

ELECTROMAGNETIC INSTABILITIES IN A SLIGHTLY RELATIVISTIC PLASMA

J. Jacquinot and C. Leloup [1969] 3 p refs In FRENCH Presented at Phys. Conf., Evian, Franch, 25-29 May 1971 1971

(CEA-CONF-1806; Conf-710527-6) Avail: AEC Depository Libraries

A solution of the relativistic dispersion relation for the electromagnetic modes with parallel propagation is given. The electron distribution function takes into account the presence of both a cold plasma and a hot anisotropic component with a loss cone. The relativistic contribution reduces strongly the growth rates for low-density cases even for rather low-energy plasmas. NSA

N72-16624# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

***THEORETICAL AND EXPERIMENTAL STUDY OF NONLINEAR PROCESSES IN A PLASMA* Ph.D. Thesis - Paris Univ., France**

Jack Olivan May 1971 167 p refs In FRENCH

(EUR-CEA-FC-602) Avail: AEC Depository Libraries

High frequency electrostatic oscillations in a plasma were studied by seeking a system of solution to the Vlasov equations. A perturbation technique was used, the magnitudes of the perturbations being expressed as a function of the amplitude of the electric potential. Under these conditions all oscillations may

be represented by the superposition of Landau and Van Kampen solutions. A mechanism was studied in which two types of solutions intervene in the oscillating current associated with the propagation of an electron plasma wave. Then, a process in which only the Landau mechanism intervenes, with a quasi-linear deformation of the distribution function is studied. Finally, the echo mechanism associated with the Van Kampen solution is considered. The three types of mechanism were studied experimentally in the plasma column of the EOS device; the results are compared with those obtained by theoretical analysis.
NSA

N72-16625# Academy of Sciences (USSR), Moscow.
EXCITATION OF LONGITUDINAL ELECTROMAGNETIC WAVES IN A BOUND PLASMA DURING INJECTION OF RELATIVISTIC ELECTRON BEAMS
I. S. Bogdankevich and A. A. Rukhadve 1971 24 p refs In RUSSIAN
(NP-19020) Avail: AEC Depository Libraries

A detailed analysis is given of the character and conditions for excitation of longitudinal electromagnetic waves in a spatially bounded magnetoactive plasma by a low density relativistic electron beam. The increments of growth and the frequency spectra of plasma waves excited by the beam were determined. Nonlinear evaluations are given of the maximum amplitudes of steady state oscillations. The results are discussed: (a) from the aspect of the possibility of using powerful relativistic electron beams to excite plasma waves of high amplitude, and (b) using the example of probing the ionosphere of the earth with a relativistic electron beam of low density.
NSA

N72-16626# Institute of Nuclear Research, Warsaw (Poland).
PENETRATION OF ELECTROMAGNETIC WAVE INTO THE PLASMA OF EXPONENTIAL DENSITY DISTRIBUTION
Aleksander Legatowicz 1971 10 p
(INR-1321) Avail: AEC Depository Libraries

The problem of penetration of a plane electromagnetic wave into plasma of exponential density distribution is considered. The problem was investigated on the basis of the linearized Vlasov equation and the wave equation for the electric field. The solution has the form of a convergent exponential series in the variable u = 1 to the (omega/c) mu xth power. The recurrence formulas for the series coefficients are given.
Author (NSA)

N72-16627# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
RADIATION LOSSES OF A THETA PINCH PLASMA IN THE WAVELENGTH RANGE 100 TO 200 ANGSTROMS
W. Engelhardt Jun. 1971 45 p refs
(IPP-1/108) Avail: AEC Depository Libraries

In order to measure the radiation losses of a theta-pinch plasma a grazing incidence spectrograph is absolutely calibrated in the range 10 to 200 A. This is done in two steps: First, the measured intensity ratios of lines emitted by hydrogen-like ions are compared with their calculated values, thus yielding the relative sensitivity of the instrument. The result is confirmed by incorporating well known intensity ratios of lithium-like ions. Secondly, absolute calibration is possible by hanging the spectrograph on an absolutely calibrated monochromator via the branching ratios of lithium-like ions. Radiation losses from the plasma turn out to be negligible compared to heat conduction losses and the whole energy radiated is found to be small compared to the energy content of the electrons, if the impurity concentration does not exceed 0.5%.
Author (NSA)

N72-16628# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
BASIC STEADY STATE MAGNETIC "SCREW"-FIELD DISTRIBUTIONS IN PLASMA BETWEEN CONCENTRIC BOUNDARIES
M. Geiger Oct. 1970 51 p refs
(LGI-70/16/E) Avail: AEC Depository Libraries

The concentric field, and dilute plasma structure extends between the surface of a pinched plasma column as inner boundary and an outer conducting shell. Particular consideration is given to pressure-determined distributions where the characteristic field inclination begins from zero and increases continuously with the radius. Model pressure functions are introduced which derive a constant multiplicator from the special distributions. The relation for the maximum permissible ratio with respect to Suydam's local stability criterion is analyzed.
Author (NSA)

N72-16629# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
CALIBRATION OF THE SILVER ACTIVATED COUNTERS ON A PLASMA FOCUS EXPERIMENT
G. Luzzi and M. Samuelli Oct. 1970 24 p refs
(LGI-70/17/E) Avail: AEC Depository Libraries

The calibration of silver-activation counters was performed for measuring the anisotropy of the neutron emission of a plasma focus device. The characteristics and the limits of the measuring system were studied.
Author (NSA)

N72-16630# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
SPACE-TIME EVOLUTION OF A PLASMA SUBJECTED TO A DISCHARGE CURRENT
C. Mercier and Soubbaramayer 1971 2 p refs In FRENCH
Presented at Phys. Conf., Evian, France, 25-29 May 1971
(CEA-Conf-1801; Conf-710527-7) Avail: AEC Depository Libraries

A mathematical model simulates the evolution of a plasma subjected to a discharge current. An expression is proposed for the thermal electronic conductivity allowing the important experimental results on T-3 (Kurchatov) and S. T. (Princeton) to be explained.
NSA

N72-16631# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
COUPLING OF em WAVES IN AN INHOMOGENEOUS PLASMA
R. Cano, M. Schwartz, and B. Zanfagna [1971] 3 p refs In FRENCH Presented at Phys. Conf., Evian, France, 25-29 May 1971
(CEA-Conf-1802; Conf-710527-2) Avail: AEC Depository Libraries

An experiment in which an extraordinary electromagnetic wave propagates through an inhomogeneous plasma in the presence of shear is discussed; under these conditions a coupling of the characteristic electromagnetic modes exists.
NSA

N72-16632# Japan Atomic Energy Research Inst., Tokyo.
TRAPPED-PARTICLE INSTABILITIES AND DIFFUSION RATES IN A TOKAMAK PLASMA
Tohru Sugawara Jun. 1971 9 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4483) Avail: AEC Depository Libraries

Low-frequency dissipative trapped-particle instabilities in a Tokamak plasma are investigated by using a simplified-model magnetic field. The cross-field particle diffusion due to these instabilities is estimated on the basis of nonlocal theory. The estimated particle-diffusion coefficients are rather small at low collision frequencies compared with the previous results of Kadomtsev and Pogutse.
Author (NSA)

N72-16633# Academy of Sciences (USSR), Moscow. Physics Inst.
PROBLEMS OF INJECTION OF RELATIVISTIC ELECTRON BEAMS INTO PLASMA
S. E. Rosinskii and A. A. Rukhadze 1971 18 p refs In RUSSIAN

(NP-19012) Avail: AEC Depository Libraries

Fields and currents induced in a dense plasma under injection of a relativistic electron beam are investigated. It is shown that in a time less than the collision time of plasma electrons the induced fields and currents represent the superposition of fields and currents accompanying the beam (static in a system of a beam at rest) and transition fields and currents, essentially caused by the very beginning of injection and disappearing over a time greater than the electron collision time. The nature and magnitude of this transition radiation are evaluated. It is shown in particular that transition fields have an almost potential character (the magnetic field is small in comparison with the electric). The problem is solved in two formulations: (1) injection of the beam with finite time tau and (2) injection of the beam in a finite interval of space between the points z = 0 and z = 1 sub 0. NSA

N72-16634# *Comitato Nazionale per l'Energia Nucleare, Frascati* (Italy). Lab. Gas Ionizzati.

TIME-SPACE RESOLVED SPECTROSCOPIC MEASUREMENTS ON A FAST Z-PINCH

R. Keller 16 Feb. 1972 27 p refs

(LGI-70/14/E) Avail: AEC Depository Libraries

The MIRAPINO experiment, a fast linear z pinch, is described. In order to study the mechanism of the collision near the axis, the pinch in noble gas is examined by varying the superposed axial magnetic field. A spectroscopic investigation was made of the visible electromagnetic radiation emitted by the plasma during and after the maximal contraction. The gas was neon in the pressure region of 100 microns HG. NSA

N72-16635# Institute of Nuclear Research, Warsaw (Poland).

UTILIZATION OF SELECTIVE CHANGE OF PLASMA OPTICAL THICKNESS TO DETERMINE THE ELECTRON DENSITY

Szymon Suckewer 1971 7 p refs

(INR-P-1322) Avail: AEC Depository Libraries

A method is presented to determine the electron density in nonthermal plasma from the line-intensity ratios of neutrals or weakly ionized atoms. It is based on the utilization of selective change of plasma optical thickness. Author (NSA)

N72-16636# Commissariat a l'Energie Atomique, Limeil (France). Centre d'Etudes.

CONTRIBUTION TO THE STUDY OF PLASMAS. AN ULTRA RAPID PHOTOMETRIC CAMERA Ph.D. Thesis - Paris Univ.

Marc R. Alpern 1971 79 p refs In FRENCH

(CEA-R-4079) Avail: AEC Depository Libraries

The limitations of image converters in ultrarapid photography are discussed, after which an electronographic camera designed to make photometric measurements on plasmas is described. The electron optics and the performance attainable, particularly in dynamic operation, are then assessed. The experimental facts concerning the interaction between a laser beam and a thin layer of gold established by use of this camera are presented; the complexity of the mechanism involved in this interaction is shown. NSA

N72-16637# Texas Technological Univ., Lubbock. Plasma Lab.

WAVE PROPAGATION AND DAMPING IN A HOT, BOUNDED PLASMA

J. E. Cato, M. Kristiansen, and M. O. Hagler 15 Aug. 1971 109 p refs

(Contract AT(40-1)-3778)

(ORO-3778-6) Avail: NTIS

A theoretical technique is presented that allows numerical investigation of wave propagation on a hot, bounded plasma. In this theory, all dielectric tensor terms are expanded in power series of the hot-plasma-expansion parameter, and at some specified order, all series are truncated. Retaining only zero-order terms yields essentially the cold-plasma theory, while retaining first or higher-order terms introduces finite temperature corrections. The introduction of these correction terms, however, requires boundary conditions in addition to those on E sub t and H sub t. When retaining only zero- and first-order terms, one additional boundary condition is required. Assuming a rigid plasma-vacuum boundary, the continuity of the normal electric field is proposed as this additional boundary condition. Numerical results are presented for the fast plasma wave propagating near the second harmonic of the ion cyclotron frequency. Under this condition, finite-temperature effects predict a strong wave-damping mechanism. Author (NSA)

N72-16638# California Univ., Livermore. Lawrence Radiation Lab.

STATISTICAL MECHANICS OF TWO-SPECIES PLASMAS, WITH APPLICATIONS TO WHITE DWARF STARS AND METALLIC HYDROGEN Ph.D. Thesis

Thomas J. Buckholtz May 1971 105 p refs

(Contract W-7405-Eng-48)

(UCRL-51055; TID-4500; UC-34) Avail: NTIS

A method of determining the equation of state for certain dense plasmas for which the usual cluster expansions of statistical mechanics fail to converge is derived. The results are applied to physical conditions such as might be found in a white dwarf star from the envelope to deep in the interior. A two-species plasma of weakly coupled electrons and strongly coupled classical ions is considered. By summing classes of diagrams, expansions are obtained in which the ion-ion interactions are removed in favor of the ion density functions of various orders. The results include three categories of terms: one ion-only term, the electron-only terms of the usual expansions, and some mixed-species diagrams. Expansions are given for three cases: classical particles and weak forces, classical electrons and Coulomb forces, and quantum electrons and Coulomb forces. Author (NSA)

N72-16639# Addis Translations International, Woodside, Calif.

POSSIBLE USES OF PLASMA IN POWDER METALLURGY, WITH PARTICULAR REFERENCE TO SPHEROIDIZATION

Wladyslaw Rutkowski and Witold Szteke Sep. 1971 43 p refs Transl. into ENGLISH from "Mozliwosci Wykorzystania Plazmy w Zaganieniach Metalurgii Proszkow, ze Szczegolnym Uwzglednieniem Procesu Sferoidyzacji" Inst. of Nucl. Res., Warsaw, rept. INR-938, 1968

(SCL-T-710281; INR-938) Avail: NTIS

A discussion is presented on aspects of applying plasma in powder-metallurgical processes, application of powders to other processes with the use of plasma, and the application of other products of powder metallurgy in plasma processes. Results obtained with the spheroidization of Al2O3, Ta, and Ni powders are presented, as are the results of metallographic and microscopic investigations on these powders. Author (NSA)

N72-16640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESULTS AND PROBLEMS OF AN INVESTIGATION OF SYNCHROTRON INSTABILITY

V. V. Zheleznyakov and E. V. Suvorov 27 Jul. 1971 38 p refs Transl. into ENGLISH from the monograph "Rezultaty i Problemy Issledovaniya Sinkhrotronnoi Neustoichivosti" 34 p

(AD-731924; FTD-HT-23-940-71) Avail: NTIS CSCL 20/9

The article has given the basic results of a study of synchrotron instability in the linear approach. The situation essentially reduced to the calculation of reabsorption coefficients of the synchrotron radiation of a system of relativistic electrons (with given distribution function in terms of momentums) and a search for criteria at which these coefficients become negative. In the linear theory of synchrotron instability there is still an unclear fundamental area of the conditions of amplification and precise magnitude of the increments in a strongly rarefied given plasma, when the macroscopic approach to the determination of the nature of normal waves becomes inapplicable. Moreover, in linear theory it is advisable to conduct a more thorough

consideration of synchrotron instability for different distribution functions of the electrons, especially when the nature of the normal wave polarization is determined by relativistic electrons.
Author (GRA)

N72-16641# Systems Research Labs., Inc., Dayton, Ohio.
ARC MOTION AND MODES IN A HOMOPOLAR DEVICE Final Report, Sep. 1967 - Aug. 1969
Heinz O. Noeske Aug. 1971 105 p refs
(Contract F33615-67-C-1344; AF Proj. 7063)
(AD-731803; ARL-71-0139) Avail: NTIS CSCL 20/9

The observed modes and the dynamic behavior of an electric arc in a homopolar device for constant current (100A) and magnetic field (1,500G) are quantitatively dependent on the type of gas (He, Ne, Ar, Xe). The peculiar behavior of the arc for both electrode polarities can be explained as a result of a competition between geometrical flow effects and the Hall effect, with the latter becoming more pronounced with decreasing pressure. The well known tendency of the cathode spot to move into the retrograde direction at low pressures under the influence of a transversal magnetic field seems only of secondary importance. No steady retrograde motion of the arc column has been observed. The Hall voltage is used to explain quantitatively the measured dynamic arc voltage as function of pressure. For all gases investigated the measured Hall parameter ($10 = \omega \cdot \tau = 0.4$) is given as function of pressure and roughly proportional to $1/p$. Also, the arc rotational frequency as function of $1/pM$ (p = gas pressure M = atomic weight) can be plotted as one curve, which suggests that for lower pressure the main loss is kinetic energy of the rotating gas which has to be replaced by the electromagnetic energy of the rotating arc. In summary, two distinct arc modes for low gas pressures can be defined depending on electrode polarity: when the center electrode is cathode, the filamented current carrying arc moves together with the gas at high azimuthal velocity in amperian direction; when the center electrode is anode the discharge becomes diffuse and stationary in regard to the laboratory and pumps the plasma with high speed in the azimuthal amperian direction. Author (GRA)

N72-16642# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
POLARIZATION PROPERTIES OF STARK SHIFTED LINES EMITTED BY A TURBULENT PLASMA, 1
Gabor Kalman and Pradip Bakshi Jun. 1971 32 p refs
(Contracts F19628-71-C-0079; Task-865905; F19628-69-C-0074)
(AD-731819; AFCRL-71-0468; SR-1) Avail: NTIS CSCL 20/9

Polarization patterns for Stark-shifted lines under the influence of a distributed electric field are derived for the case of unequal source strengths for pi and sigma polarized emission in order to understand the unexpected experimental results of the AFCRL group. Expressions are obtained for the elements of the density matrix as functions of the direction of observation and the polarizer angle, and guidelines are established for further experimental observations. Author (GRA)

N72-16643# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF EQUILIBRIUM AND STABILITY OF HIGH CURRENT, SELF-CONSTRICTING DISCHARGES IN A DENSE OPTICALLY TRANSPARENT PLASMA OF FINITE CONDUCTIVITY
A. A. Rukhadve and S. A. Triger 14 Sep. 1971 38 p refs Transl. into ENGLISH from Tr. Fiz. Inst., Akad. Nauk SSR (Moscow), 1969 p 1-42
(Contract F33657-71-D-0057; DIA-Task-T66-01-08)
(AD-732279; FTD-HC-23-827-71; Preprint-26; NP-17953) Avail: NTIS CSCL 20/9

The study is a logical continuation of a preceding study, which presents the results of a theoretical analysis of the equilibrium and stability of a high-current, self-constricting discharge in an optically transparent plasma, with allowance for volume emission. Cases of simple cylindrical discharge (z-pinch) and discharge with an inverse central current (inverse pinch) were studied. It is found that discharge in an optically transparent plasma is subjected, along with strong instability (constriction and deflection), to over-heated instability, which - in the low-temperature interval in which we are interested-develops the most rapidly. The increments for the development of a different type of instabilities are calculated, and the discharge parameters satisfying the required duration conditions are determined. Author (GRA)

N72-16644# New York Univ., N.Y. Dept. of Electrical Engineering.
NONLINEAR EXCITATION OF WAVES IN A PLASMA BY HIGH POWER MICROWAVES
James C. Shiue Feb. 1971 287 p refs
(Contracts N00014-67-A-0467-0018; Nonr-285(66); NR Proj. 371-147)
(AD-731392; TR-402-6) Avail: NTIS CSCL 20/9

Nonlinear excitation of electron plasma and ion acoustic waves in an isotropic electron-ion plasma has been investigated theoretically and experimentally. A parametric theory based on a fluid description of the plasma taking into account the vector characters of the pumping and driven waves is developed which displays the directional characteristic of the threshold. A transmission line equivalent circuit is used to represent a plasma slab from which the ratio of the E fields of an E-polarized incident electromagnetic wave to the electron plasma wave inside the plasma at a Tonks-Dattner resonance is ascertained. Experiments are conducted on argon and mercury plasmas in C-Band waveguides with C.W. and pulsed microwaves. The minimum threshold microwave power observed is 10 Watts. Pulsed experiments show details of suppression of spontaneous oscillations in the plasma and subsequent excitation of ion acoustic waves. The dependence of the threshold microwave power on background plasma parameters is in qualitative agreement with theory. Author (GRA)

N72-16645# RCA Victor Co., Ltd., Montreal (Quebec).
STRONG FIELD ELECTROMAGNETIC WAVE PHENOMENA IN PLASMAS Final report, Jan. 1970 - Feb. 1971
Morrel P. Bachynski, Brian W. Gibbs, and Issie P. Shkarofsky Feb. 1971 104 p refs
(Contract F19628-70-C-0093; Task-464202)
(AD-731227; PSP-102; AFCRL-71-0330;) Avail: NTIS CSCL 20/9

A series of investigations on Strong Field Electromagnetic Wave Phenomena in Plasmas has been carried out. The major accomplishments include: Development of theory for strong field electromagnetic wave interaction with plasmas including electron-electron collisions and extensive calculations on thermalization; Computations of effect of including progressive attenuation of wave in plasma; Determination of influence of electron-neutral collisions on variation of electron temperature with field strength of wave; Double electrical probe measurements showing decreased electron density in late afterglow in presence of strong electromagnetic fields; Measurement of decreased attenuation for increased field strength in region of cyclotron resonance; Development of theory for strong field modulated wave interaction in plasmas for large changes induced in electron temperature; Discovery of electrostatic fields in the plasma for incident transverse electro-magnetic waves; Study of pulse distortion by the plasma. Author (GRA)

N72-16646# Wisconsin Univ., Madison. Mathematics Research Center.
ASYMPTOTIC THEORY OF NONLINEAR WAVE MOTIONS IN MAGNETOHYDRODYNAMICS. PART 3: AXISYMMETRIC WAVES
M. C. Shen Jul. 1971 27 p refs
(Contract DA-31-124-ARO(D)-462; Grant NSF GP-18641)
(AD-732045; MRC-TSR-1141-PT-3) Avail: NTIS CSCL 20/9

An asymptotic approach based upon Lundquist equations is developed for the study of nonlinear wave propagation on a

pinch cylindrical plasma. Wave speed and asymptotic evolution equations are derived. A comparison between linear stability criteria and results of the non-linear theory is made and a set of refined stability criteria is obtained. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-16647 National Lending Library for Science and Technology, Boston Spa (England).
STUDY ON THE DAMAGE PRODUCED BY X-RAYS ON TRIGLYCINE SULPHATE
J. Mendiola and C. Alemany 19 Oct. 1971 11 p refs Transl. into ENGLISH from Electron. Fis. Apl. (Madrid), v. 13, 1970 p 237-242
(NLL-Trans-842-(9022.64)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Measurements of Sigma prime sub maximum, Tau sub Sigma prime maximum, P sub S, and E sub C have been carried out after irradiating TGS monocrystals with X-rays from copper of 40kV and 20 MA. A study has been made of the variations in intensities of the X-ray diffraction as a consequence of the damage produced by irradiation. A description is given of the damage mechanism based on the mosaic structure of the crystals. Author

N72-16648 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRICAL PROPERTIES OF GALLOSELENIDES OF THE RARE-EARTH METALS
G. V. Samsonov, Yu. B. Paderno, M. I. Murgusov, and V. P. Fredorchenko 10 Oct. 1971 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorg. Mater. (USSR), v. 4, no. 8, 1968 p 1225-1228
(NLL-RRE-Trans-350-(8036.625)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Galloselenides of the MGaSe3 composition, where M is La, Ce, Pr, Nd, or Sm, were obtained by the ampule synthesis method. The compact samples were prepared from powders, and their baking and annealing regimes were studied. The temperature dependence of the resistivity and of the thermal emf over the 300 to 1000 K range was measured. It was established that the MGaSe3 compounds have a conductance of semiconductor nature. The tendency for the forbidden zone width, melting temperature, and microhardness of the galloselenides to increase from lanthanum to samarium is connected with the increase in the number of outer electrons, which are localized into the stable f7 configurations. Author

N72-16649 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF NEW SHALLOW DIFFUSION TECHNIQUES IN SILICON FOR MICROWAVE STRUCTURES
M. Croset and L. Mercandalli 6 Dec. 1971 39 p refs Transl. into ENGLISH from Rev. Tech. Thomson-CSF (France), v. 3, no. 1, Mar. 1971 p 37-39
(NLL-Trans-2797-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

Methods of diffusion in silicon, using boron, phophorous, or arsenic oxides in vitreous form as sources, are described. The operating parameters are limited only to the silicon and source temperatures and the processing time. The use of inert processing atmospheres avoids the creation of silica and make it possible to obtain, directly, diffusions in which the surface concentration and depth concentration are varied and reproducible. The diffused layers were characterized by chemical determination and electrical measurements. Their crystallographic properties were investigated by X-ray topography and chemical attack. Author

N72-16650*# Radio Corp. of America, Princeton, N.J.
VAPOR PHASE GROWTH SYSTEM AND ITS USE IN THE PREPARATION OF SEVERAL III-V COMPOUND SEMICONDUCTORS Final Report, 15 Mar. 1967 - 14 Dec. 1970
R. E. Enstrom, E. A. Miller, and A. G. Sigai Dec. 1971 112 p refs
(Contract NAS12-538)
(NASA-CR-1886) Avail: NTIS CSCL 20L

Vapor growth and characterization of AlAs, Al(1-x)In(x)P, GaN, In(1-x)Ga(x)P, and GaAs(1-x)Sb(x) were emphasized. A compatible vapor phase system for the preparation of III-V compounds was attained. For individual titles, see N72-16651 through N72-16661.

N72-16651*# Radio Corp. of America, Princeton, N.J.
VAPOR PHASE GROWTH SYSTEM AND ITS USE IN THE PREPARATION OF SEVERAL III-V COMPOUND SEMICONDUCTORS: INTRODUCTION, TECHNICAL DISCUSSION, CONCLUSIONS, RECOMMENDATIONS, AND NEW TECHNOLOGY APPENDIX
In its Vapor Phase Growth System and Its Use in the Prepn. of Several III -V Compound Semicond. Dec. 1971 p 1-26 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

A method of vapor growth was developed to permit the preparation of compounds containing In and Sb. GaAs, GaP, GaSb, InAs, and InP were prepared as single crystals. Alloys of GaAs(1-x)P(x), InAs(1-x)P(x), GaAs(1-x)Sb(x), Ga(1-x)In(x)As, and In(1-x)Ga(x)P were also grown as pure, single crystalline epitaxial layers. P- and n-type doping and the preparation of multilayer structures in selected materials were achieved. The preparation of III-V compounds containing Al and nitrogen by the addition of Al and NH3 sources was investigated. The growth and characterization of In(1-x)Ga(x)P alloys were continued because of their potential for visible electroluminescence. The growth of AlAs, GaN, GaSb, and In(1-x)Ga(x)N, and the vapor growth of AlN, AlP, and In(1-x)Ga(x)N, were investigated. The purity and crystalline perfection of vapor-grown AlAs were improved, and the growth of Al(1-x)In(x)P and In(1-x)Ga(x)P alloys with improved crystalline perfection and good control of alloy composition was also continued. GaN single crystalline layers with improved electrical properties and a lower donor concentration, and GaAs(1-x)Sb(x) alloy, were prepared. The growth of such a wide variety of III-V compounds demonstrates the versatility and utility of this vapor growth system. K.P.D.

N72-16652*# Radio Corp. of America, Princeton, N.J.
THE VAPOR PHASE GROWTH OF SEVERAL III-V COMPOUND SEMICONDUCTORS, APPENDIX A
J. J. Tietjen, R. E. Enstrom, and D. Richman *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 27-34 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

A review is presented of a vapor phase growth method which was used for the synthesis of a broad spectrum of III-V compounds. This technique features the use of gases as the source chemicals which provide improved control of the chemical composition, homogeneity, crystalline perfection, and impurity concentrations and distributions of the epitaxial layers.

N72-16653*# Radio Corp. of America, Princeton, N.J.
THE PREPARATION AND PROPERTIES OF VAPOR-DEPOSITED SINGLE-CRYSTALLINE GaN, APPENDIX B
H. P. Maruska and J. J. Tietjen *In its* Vapor Phase Growth System and Its Use in the Prepn. of several III-V Compound Semicond. Dec. 1971 p 35-38 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

Single crystalline, colorless GaN was prepared by a vapor phase growth technique. These crystals are suitable for electrical and optical evaluation of this compound. It was determined that GaN has a direct energy bandgap of 3.39 eV, and that undoped crystals prepared by this method have a very high inherent electron concentration, typically above 10 to the 19th power/cu cm, which is probably related to a high density of nitrogen vacancies. Conducting p-type specimens were prepared using Ge as the dopant. This result was difficult to reproduce, and the samples were electrically inhomogeneous. Author

N72-16654*# Radio Corp. of America, Princeton, N.J.
THE PREPARATION AND PROPERTIES OF VAPOR GROWN In(1-x)Ga(x)P, APPENDIX C
C. J. Nuese, D. Richman, and R. B. Clough *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 39-50 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

In(1-x)Ga(x)P was prepared over the entire alloy system by an epitaxial vapor phase growth technique. The energy gap dependence on alloy composition for these layers was determined by optical absorption, Schottky barrier photoresponse, and electroluminescence measurements. These measurements indicate a nonlinear dependence of the (direct) conduction band minimum on In(1-x)Ga(x)P composition, and a direct-indirect energy gap crossover at 2.20 eV and 70% GaP at room temperature. Zn-diffused p-n junctions were formed in the In(1-x)Ga(x)P layers and were found to be reasonably well-behaved in regard to their IV and CV characteristics and their photoresponse. The electroluminescent emission spectra contain an narrow high energy near-bandgap peak but are frequently dominated by low energy impurity peaks. For indirect bandgap alloys, impurity peaks lie approximately 0.25 and 0.5 eV less than bandgap. A third peak is found at an energy of 1.30 to 1.35 eV independent of composition, for X > or = 0.4. Author

N72-16655*# Radio Corp. of America, Princeton, N.J.
VAPOR GROWTH OF Ga(1-x)In(x)As ALLOYS FOR INFRARED PHOTOCATHODE APPLICATIONS, APPENDIX D
R. E. Enstrom, D. Richman, M. S. Abrahams, J. R. Appert, D. G. Fisher, A. H. Sommer, and B. F. Williams *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 51-61 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

Vapor phase epitaxial growth was used to prepare G a(1-x)In(x)As alloy layers for refle ction and transmission photocathodes sensitive in the infrared. Reflection cathodes about 20 micrometers thick were made up of graded layers to reduce strain. Alloy layers as thin as 1 micrometer were prepared for use as transmission photocathodes. Minority carrier diffusion lengths greater than 1 micrometer were measured for GaAs and Ga(0.94)In(0.06)As layers doped to about 10 to the 19th power holes/cu cm. The photoemissive properties were found to be strongly dependent upon alloy composition. White light sensitivity decreased monotonically with increasing InAs content; quantum yield and IR sensitivity attained maximum values. Alloys with clean surfaces and proper composition and acceptor concentration were activated with cesium and oxygen to quantum efficiencies of about 2.0% in reflection and 1.0% in transmission at 1.06 micrometers. In addition, bandgap-limited emission out to 1.3 micrometer was observed. Author

N72-16656*# Radio Corp. of America, Princeton, N.J.
VAPOR GROWTH AND PROPERTIES OF AlAs, APPENDIX E
M. Ettenberg, A. G. Sigai, A. Dreeben, and S. L. Gilbert *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 62-69 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

Aluminum arsenide epitaxial layers on GaAs substrates were prepared by a continuous flow, vapor transport technique employing AlCl and AsH3. It was found that for all practical experimental conditions, the reaction of AsH3 and AlCl takes place at the point of mixing of the reactive gases. This behavior is consistent with a thermochemical analysis of the AlAs growth. The bandgap of AlAs was determined by optical absorption to be 2.17 eV and indirect. Hall and resistivity measurements made on epitaxial layers removed from the substrates indicate that the material, as grown, is of the n type, with electron concentrations ranging from 6 x 10 to the 18th power to 4 x 10 to the 17th power/ cu cm, with corresponding room temperature mobilities varying between 75 and 280 sq cm/V sec. While the material does degrade in air, it was found to be stable enough to allow ample time for device fabrication and protection. Author

N72-16657*# Radio Corp. of America, Princeton, N.J.
PHOTO- AND CATHODOLUMINESCENCE IN VAPOR-GROWN AlAs, APPENDIX F
H. Kressel, F. H. Nicoll, M. Ettenberg, W. M. Yim, and A. G. Sigai *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 70-73 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

Observation of luminescence in n-type single crystal AlAs grown by vapor phase epitaxy is discussed. Silicon is the dominant donor, and Mg is the dominant acceptor. At 77 K, the emission spectra are dominated by bands at 2.16 and 1.73 eV, while at 7 K the emission is mostly via a band at approximately 2.1 eV. It is estimated that the optical ionization energy of Si donors in AlAs is about 73 meV and that of Mg acceptors is about 60 meV. Author

N72-16658*# Radio Corp. of America, Princeton, N.J.
THERMAL EXPANSION OF AlAs, APPENDIX G
M. Ettenberg and R. J. Paff *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 1-26 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

The lattice parameter of AlAs was measured as a function of temperature, between 15 and 840 C, and the coefficient of thermal expansion was determined. The lattice parameter at 0 C is 5.6605 + or - 0.00005 A, and the coefficient of thermal expansion is (5.20 + or - 0.05) X 0.000006/deg C. A comparison to GaAs was made, which indicates that there is a perfect lattice match at about 900 C and a 0.14% lattice mismatch at room temperature. Author

N72-16659*# Radio Corp. of Ameri ca, Prin ceton, N.J.
THE PREPARATION OF VISIBLE-LIGHT-EMITTING p-n JUNCTIONS IN AlAs, APPENDIX H
C. J. Nuese, A. G. Sigai, M. Ettenberg, J. J. Gannon, and S. L. Gilbert *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 78-82 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

P-n junctions were formed in AlAs by diffusing Zn into single crystal, n-type vapor-grown AlAs layers. IV, CV, and photovoltage measurements indicate well-behaved junctions at room temperature, with external electroluminescent efficiencies on the order of 0.00001. The room temperature forward bias emission spectrum consists of a narrow yellow-green peak at 2.146 eV and two board infrared peaks at 1.66 and 1.35 eV. At 600 K and 3 V reverse bias, current densities of 0.001 A/sq cm were observed, which are nearly an order of magnitude smaller than those for similarly prepared GaAs junctions. Author

N72-16660*# Radio Corp. of America, Princeton, N.J.
VAPOR-PHASE GROWTH OF EPITAXIAL GaAs(1-x)Sb(x) ALLOYS USING ARSINE AND STIBINE, APPENDIX I
R. B. Clough and J. J. Tietjen *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound

Semicond. Dec. 1971 p 83-88 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

A technique using the gaseous hydrides arsine and phosphine, was extended to grow single crystalline GaAs(1-x)Sb(x) by replacing the phosphine with stibine. Procedures were developed for handling and storing stibine. Layers of p-type GaSb and GaSb-rich alloys were grown with carrier concentrations comparable to the lowest reported. In addition, a p-type alloy containing 4% GaSb exhibited a mobility of 400 sq cm /V sec.
Author

N72-16661*# Radio Corp. of America, Princeton, N.J.
THE PREPARATION AND PROPERTIES OF VAPOR DEPOSITED EPITAXIAL InAs(1-x)P(X) USING ARSINE AND PHOSPINE, APPENDIX J
J. J. Tietjen, H. P. Maruska, and R. B. Clough *In its* Vapor Phase Growth System and Its Use in the Prepn. of Several III-V Compound Semicond. Dec. 1971 p 89-95 refs (See N72-16650 07-26)
Avail: NTIS CSCL 20L

Single crystalline InAs(1-x)P(x) layers were prepared by a vapor phase growth technique. These alloys exhibit the highest electron mobilities yet reported for this system. Electron mobility data are reported for the alloys at 77 K. At this temperature, a mobility value of 120,000 cm sq cm/V sec was measured for InAs. Vegard's law is obeyed over the entire composition range. Both n- and p-type doping was achieved during vapor growth to provide a broad range of electrical resistivities and p-n junctions.
Author

N72-16662# Joint Publications Research Service, Washington, D.C.
PREPARATION AND ELECTRICAL PROPERTIES OF THIN LAYERS OF SOME SEMICONDUCTOR COMPOUNDS A(II)B(V)
G. B. Bokiy, V. Ya. Hevchenko, G. I. Goncharenko, A. D. Goncharov, P. Rudolf, I. M. Olkhovskiy, A. V. Sandulova, and L. D. Khutoryanskiy 26 Jan. 1972 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 200, no. 1, 1971 p 72-74
(JPRS-55037; UDC-546.05.03; CSO-01069/72-S) Avail: NTIS

A method is described for preparing thin layers of CdSb and Cd3As2 involving the crystallization of a molten layer compressed between two substrates. The CdSb melts congruently and the Cd3As2 melts incongruently, indicating that the techniques can be generalized for a wide class of substances. The heating and melting of the specimen, compressing, and crystallization procedures are outlined. Curves showing the temperature dependence of the Hall constant, resistivity, and mobility for various thicknesses of layers are given. The results show that the method can be useful in preparing thin layers for matrix fabrication in integrated circuits.
N.E.N.

N72-16663# Brookhaven National Lab., Upton, N.Y.
RECENT DEVELOPMENTS IN PULSED MAGNET MULTIFILAMENT SUPERCONDUCTING WIRES
A. D. McInturff, P. F. Dahl, W. B. Sampson, and K. E. Robins 30 Jun. 1971 23 p refs Presented at Thermonuclear Inform. Meeting, Oak Ridge, Tenn., Jun. 1971 Sponsored in part by AEC
(BNL-16026; Conf-710625-1) Avail: NTIS

It has been noted that the introduction of a metallic or intermetallic insulator to bond the individual multifilamentary wires into a fully transposed or partially transposed conductor, e.g., braid, greatly enhances the performance of the magnets constructed with them. The wires in these conductors tend to be coupled at low db/dt, thus leading to high losses. Data are presented showing a metallic and intermetallic insulated braid with excellent magnet performance while maintaining losses comparable to that of an organically insulated braid (wire to wire) for rise times of db/dt greater than or equal to 5 kG/sec.
Author (NSA)

N72-16664# United Kingdom Atomic Energy Authority, Culham (England).
REPORT ON THE CULHAM SUPERCONDUCTING LEVITRON
D. N. Cornish May 1971 11 p Presented at the Symp. on Electromagnetic Suspension, Southampton, Engl., 12-14 Jul. 1971
(CLM-P-275; Conf-710715-1) Avail: AEC Depository Libraries

This machine is being built to study the stability and confinement of hot plasma trapped in the magnetic field around a levitated superconducting ring carrying half a million ampere turns. Superconducting coils up to 1.2 meters mean diameter, and built by the latest techniques, are incorporated in the vacuum system to provide the vertical field. A brief description of this equipment, concentrating on the superconducting aspects, is presented together with performance data for the coils.
Author (NSA)

N72-16665# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
GROWTH OF CRYSTALS IN THORIUM OXIDE GEL
T. Bazzan and T. Cabrini 21 Oct. 1970 24 p refs In ITALIAN (RT/CHI-(70)36) Avail: AEC Depository Libraries

Studies to investigate the grain growth kinetic process in thoria gels are described. The experimentally derived kinetic law is given with a Q value of 1.67 eV and a prevailing diffusive mechanism. At 1200 C the gel density is almost the theoretical one.
Author (NSA)

N72-16666# Danish Atomic Energy Commission, Risoe.
SECONDARY HIGH-TEMPERATURE CREEP OF POLYCRYSTALLINE MAGNESIUM OXIDE
J. B. Bilde-Soerensen Jun. 1971 95 p refs In DANISH; ENGLISH summary
(RISO-M-1385) Avail: AEC Depository Libraries

The secondary creep of polycrystalline magnesium oxide with grain sizes of 100 and 190 micrometers was examined at temperatures between 1300 and 1460 C and at compressive loads between 2.5 and 5.5 kip/mm sq. The dependence of creep rate upon load follows a power law with an exponent of 3.2. The process is thermally activated with an activation energy of 76 + or - 12 kcal/mole. The creep rate is independent of grain size. The total dislocation density follows the relation G = bG square root of e that is commonly found for metals. The dislocation structure is a three-dimensional network which contains dislocations lying in their glide plane as well as dislocations lying in their climb plane. On the basis of this structure a model is proposed in which the main contribution to the deformation comes from glide but the rate-limiting process is diffusion-controlled. The agreement with the experimental results is within one order of magnitude.
NSA

N72-16667# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.
SERRATED YIELDING IN SINGLE CRYSTALS OF SILVER-INDIUM ALLOYS
J. D. Johnson and A. A. Hendrickson [1971] 17 p refs
(Contract AT(11-1)-916)
(COO-916-24) Avail: NTIS

Serrated yielding was observed in tensile tests of high purity single crystals of Ag-9.6 at % In. The temperature dependence of the critical strain for the onset of serrations was measured. The estimated apparent activation energy is 0.6 to 1.0 eV. Techniques of preparing high purity and relatively strain free Ag-In single crystals of a selected orientation are discussed.
Author (NSA)

N72-16668# Iowa State Univ. of Science and Technology, Ames.
MICROWAVE ABSORPTION IN TERBIUM, ERBIUM, AND MnAu2 AT SELECTED FREQUENCIES FROM 20 TO 120

GHz Ph.D. Thesis
Lynn Winterton Hart Sep. 1971 151 p refs
(Contract W-7405-Eng-82)
(IS-T-471) Avail: NTIS

Ferromagnetic resonance at 24 GHz was used to experimentally confirm free-lattice-model behavior in Tb at low microwave frequencies. The resonances for T < 140 K were only observable when H sub dc was not precisely aligned along an a-axis in the hexagonal plane of the sample. MnAu2 has planar spiral magnetic ordering below a Neel temperature of 363 K. Microwave absorption studies of polycrystalline MnAu2 were used to observe perhaps five distinct magnetic resonances. Microwave absorption studies of Er single crystals were made at 24 and 100 GHz. No spin wave resonance absorption was observed with a magnetic field along the <0001>, <1010>, or <1120> directions in Er at either of our two experimental frequencies, in accord with theory. Author (NSA)

N72-16669# Iowa State Univ. of Science and Technology, Ames.
SUPERCONDUCTIVITY OF Pb-Bi ALLOYS UNDER HIGH PRESSURE Ph.D. Thesis
Robert Edwin Jones, Jr. Sep. 1971 129 p refs
(Contract W-7405-Eng-82)
(IS-T-482) Avail: NTIS

The superconducting behavior of Pb sub 0.4-Bi sub 0.6 alloys was studied under pressure to 20 kbar using piston-cylinder devices with a clamp technique. Nearly hydrostatic conditions were achieved by use of powdered Teflon or a 1:1 mixture of isoamyl alcohol and pentane as pressure-transmitting media; a Sn manometer was employed to determine the pressure directly at cryogenic temperatures. The superconducting transitions were detected by ac susceptibility measurements. At low pressures, these alloys are a mixture of two different phases; alpha, the rhombohedral phase which is nearly pure Bi, and beta, the hcp phase with 33 to 40 at. % Bi; however, a pressure of 16 kbar or more at room temperature transforms these alloys into a dhcp phase. This dhcp phase was found to be superconducting with a T sub c of approximately 8.0 K, which is slightly less than the T sub c of 8.5 K of the aplha-beta phase. Author (NSA)

N72-16670# Battelle Memorial Inst., Columbus, Ohio.
HIGH TEMPERATURE CREEP OF URANIUM DIOXIDE
Martin S. Seltzer, Alan J. Markworth, Allan H. Clauer, Benjamin A. Wilcox, and James S. Perrin Jul. 1971 46 p refs
(Contract W-7405-eng-92)
(BMI-1912) Avail: NTIS

Experiments were performed to determine the influence of temperature, stress, grain size, density, and deviation from stoichiometry on the compression creep characteristics of uranium dioxide. Studies were performed using single crystals and both enriched and depleted polycrystals of UO2 sub plus x, where $0.0001 < x > 0.121$. The effects of the variables investigated on the minimum creep rates are interrelated and a regression analysis was performed on the data in order to establish the equations which best describe the influence of these variables on the creep of uranium dioxide. Author (NSA)

N72-16671# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIAL ISSUE ON SUPERCONDUCTIVITY
16 Aug. 1971 6 p Transl. into ENGLISH from Elektrotechnicky Casopis (Czechoslovakia), v. 21, no. 4-6, 1970 p 241-242
(Contract F33657-71-D-0057; AF Proj. 3145)
(AD-732273; FTD-HC-23-291-71) Avail: NTIS CSCL 20/3

The article consists of the introduction to a conference held at Smolenice, Czechoslovakia 23-27 June 1969 sponsored by the Electrotechnical Institute of the Slovak Academy of Sciences. The following topics were discussed: theory of superconductivity, superconducting magnets, electrical machines and cables and other applications. Nineteen papers were presented, of which seventeen are published in full in the present proceedings, and two as abstracts only. GRA

N72-16672# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROBLEMS RELATING TO THE THEORY OF THE JOSEPHSON EFFECT
Yu. M. Ivanchenko 18 Aug. 1971 15 p refs Transl. into ENGLISH from Mono. Voprosy Fiz. Kondensirovannogo Sostoyaniya (USSR), 1969 p 107-114
(AD-731912; FTD-HC-23-744-71) Avail: NTIS CSCL 20/12

The broadening of Josephson radiation of a superconducting tunnel structure was studied on the assumption of quantization of interaction between electrons and electromagnetic field. Consequently, taking into account the noise stress on the barrier, caused during the final temperatures by the flow of a quasipartial current and external source noises, a given functional dependence of the current amplitude can be obtained. The dependence, however, is of an appraisable character only, as the result depends substantially on the form of spectrum, which in this article is of a Gaussian type. The dependence of multiplier F, which suppresses the amplitude with decreasing delta W (at a wide band of emitted frequencies), was calculated. The relation makes it possible to see that the amplitude drops by a similar given frequency band. Author (GRA)

N72-16673# Alabama Univ., University. Bureau of Engineering Research.
TEMPERATURE VARIATION OF DC CHARACTERISTICS IN NEUTRON-IRRADIATED TRANSISTORS Final Technical Report, 18 May 1970 - 30 Jun. 1971
Wilford D. Raburn and David Mathews Aug. 1971 67 p refs
(Contract DAAH01-70-C-1008)
(AD-731864; BER-134-82) Avail: NTIS CSCL 09/1

The purpose of the report is to describe simple techniques which have been developed for predicting the dc behavior of bipolar transistors which have been irradiated with fast neutrons. Equations were developed for the currents measured at the terminals of the transistor (active region of operation) in terms of junction bias voltage, current injection level, operating temperature, and fast neutron fluence (neutrons/sq cm). Terminal currents are modeled as consisting of internal current components, each of which is associated with either a recombination process or a current injection across the emitter-base junction. Low injection effects are considered first, and then high injection effects are shown to follow from modification of certain terms in the equations. Lattice damage is shown to appear mainly in the form of carrier lifetime degradation. As a primary goal and a check on the veracity of the equations developed, the current gain, h sub FE, of a number of transistor samples was predicted from pretest data and compared with experimantal results. A number of extra electrical parameters were monitored as a cross-check of the model assumed. A double diffused structure with approximately exponentially-graded base was chosen for a number of calculations made for verification of the model, but only the emitter-base junction profile is crucial to the current-component technique if certain parameters are measured directly. Author (GRA)

N72-16674# Army Electronics Command, Fort Monmouth, N.J.
ANOMOLOUS FERROELECTRIC HYSTERESIS LOOPS
Francis J. Murdoch Sep. 1971 58 p refs Work based on M.S. Thesis submitted to Polytechnic Inst. of Brooklyn
(Task-1S6-62705-A-057-05)
(AD-732336; ECOM-3478) Avail: NTIS CSCL 20/12

Materials that exhibit anomalous ferroelectric hysteresis loops appear throughout the literature. These loops have irregular shapes that diverge from the normal hysteresis loop which is characteristic of most ferroelectrics. The observation of a unique hysteresis loop found from measurements on single crystals of lead strontium titanate is reported. The shape of each loop was found to depend on frequency, electric field strength, and temperature. The results of these observations were examined to determine if there is a correlation between them and any known anamolous loops. It was found that our hysteresis loops have the same general appearance as the loops exhibited by pre-polarized barium titanate. Author (GRA)

N72-16675# Air Force Systems Command, Wright-Patterson AFB, Ohio.
NEMATIC LIQUID CRYSTALS FOR AIR FORCE DISPLAYS Technical Report, Oct. 1969 - Sep. 1970
Martin A. Berwick, Rudolph A. Champa, Denver Hale, Lawrence A. Knaak, and Roger Rondeau Jul. 1971 84 p refs
(Task-736003)
(AD-731758; AFML-TR-71-72) Avail: NTIS CSCL 09/5

Possible applications for nematic liquid crystals in Air Force displays are examined. A number of homologous liquid crystal series were synthesized in an attempt to expand the nematic temperature range. Several systems which are nematic well below room temperature in a stable phase were found. The factors influencing dynamic scattering were examined with regard to modes of activation, response times, relaxation times and opacity. Several feasibility devices demonstrating the use of nematic liquid crystals in displays were constructed.
Author (GRA)

N72-16676# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
ULTRASONIC STUDY OF THE BETA-TO-OMEGA PHASE IN Zr-Nb ALLOYS
Claude Goasdoue, Paul S. Ho, and Stephen L. Sass 27 Sep. 1971 22 p refs
(Contract N00014-67-A-0077-0012; NR Proj. 031-734)
(AD-731712; MSC-1648; TR-5) Avail: NTIS CSCL 11/6

Elastic constant, ultrasonic attenuation and x-ray measurements were made as a function of temperature on Zr-Nb single crystals in order to study the mechanism of the Beta to Omega phase transformation. In the Zr-20 wt. pct. Nb alloy C sub 44 decreased with decreasing temperature starting at 330-340 K reaching a minimum at 160 K, while both C, and C sub 11 showed a positive deviation from linear quasiharmonic behavior starting at 250-280 K. These observations are reversible with temperature. X-ray measurements indicated that little if any Omega phase was present in the 20 wt. pct. Nb alloy at 300 K and that upon cooling to 89 K a small amount of Omega was formed. It was suggested that the positive deviation of C sub 11 and C, from the extrapolated values based on quasiharmonic theory is due to the presence of the Omega phase and that the onset of the Beta to Omega transformation is indicated by the first sign of deviation from linearity. The negative deviation of C sub 44 from quasiharmonic behavior is attributed to a softening of the b.c.c. structure which is a precursor to the actual transformation. The observations on the Zr-25 wt. pct. Nb alloy are in general agreement with these suggestions. In the Zr-30 wt. pct. Nb alloy the X-ray results indicated that no Omega phase is present over the temperature range 89-300 K and C sub 11, C, and C sub 44 all showed a normal linear variation with temperature, in agreement with the above suggestions.
Author (GRA)

N72-16677# Aerospace Corp., El Segundo, Calif. Materials Science Lab.
QUANTUM YIELDS OF SILVER ION REDUCTION ON TiO2 AND ZnO2 SINGLE CRYSTALS Final Report, Oct. 1969 - Apr. 1971
Paul D. Fleischauer, H. K. Alan Kan, and John R. Shepherd 15 Aug. 1971 18 p refs
(Contract F040701-71-C-0172)
(AD-732285; TR-0172(9250-04)-1; SAMSO-TR-71-235) Avail: NTIS CSCL 20/12

Photogenerated charge carriers near a semiconductor or insulator solid surface may interact with adsorbed ions on the solid surface and result in a change in the charge-state of the adsorbate. The interaction of nonequilibrium charge carriers with adsorbed species at a solid-liquid interface is a typical phenomenon and occurs in many systems. The work has been concentrated on two such systems, silver ion on zinc oxide and on titanium dioxide. Direct kinetic measurements of the rate of metallic silver formation on the substrate surfaces have involved the analysis of silver by a combination method involving spectral transmission and electrochemical and atomic absorption techniques. The quantum efficiency of the continuous silver deposition process is independent of the exciting light intensity when the wavelength of the maximum excitation is 365 nm. The measured yield does depend, however, on solution silver ion concentration; the yield increases with increasing Ag(-) concentration reaching a maximum at high concentrations. A mechanism that describes the photodeposition reaction is presented.
Author (GRA)

N72-16678# Florida Univ., Gainesville. Dept. of Metallurgical and Materials Engineering.
STRUCTURE, PROPERTIES AND RADIATION SENSITIVITY OF ELECTRICALLY BISTABLE MATERIALS Semiannual Report, 6 Feb. - 6 Sep. 1971
Derek B. Dove, Larry L. Hench, Robert W. Gould, and Ronald E. Loehman 6 Sep. 1971 128 p refs
(Contract DAHC04-70-C-0024; ARPA Order 1562; AROD Proj. P-8993-P)
(AD-731298; TR-3; SAR-2) Avail: NTIS CSCL 20/12

This semiannual report contains copies of papers to be published in the proceedings of the Fourth Internationl Conference on Amorphous and Liquid Semiconductors. The first reports measurements on the thermal properties of germanium selenides using differential thermal analysis; the second describes changes in local atomic order in thin films of composition GeTe2 produced by deposition conditions and heat treatment; the third paper summarizes work on the effect of microstructure on the radiation sensitivity of semiconducting glasses. Also included is a discussion of the structure of amorphous Ge(x)Se(1-x) films and their response to heat treatment.
Author, (GRA)

N72-16679# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
TRANSMISSION ELECTRON MICROSCOPY INVESTIGATIONS OF FATIGUED COPPER SINGLE CRYSTALS, EXPERIMENTAL ASPECTS
Arthur H. Purcell and Tohannes Weertman 1 Oct. 1971 79 p
(N00014-67-A-0356-0016; NR Proj. 031-725)
(AD-732016; TR-11; Rept-5345-418) Avail: NTIS CSCL 20/12

Dislocation configurations in slices of material taken ahead of the fatigue crack tip in copper single crystals were observed through transmission electron microscopy. These observations revealed (a) a distinct transition in configuration as a region within approximately 250 microns of the crack tip was approached and (b) a reduction in dislocation cell size with decreasing distance from the crack tip similar in form to cell-size-vs-fatigue-stress-increase curves. These observations lend support to the concept of a distinct plastic zone in the vicinity of the fatigue crack tip, with associated blunting-type crack propagation mechanisms.
Author (GRA)

N72-16680# California Univ., La Jolla. Dept. of Physics.
HIGH TEMPERATURE SUPERCONDUCTORS: AN EMPIRICAL APPROACH TO SUPERCONDUCTIVITY Final Report
Bernd T. Matthias 14 Oct. 1971 22 p
(Grant AF-AFOSR-0631-67; AF Proj. 9764)
(AD-732241; AFOSR-71-2324TR; Rept-61102F; Rept-681306) Avail: NTIS CSCL 20/12

The superconducting transition temperature has been raised to 21 degrees K, the critical magnetic field to 415 kilogauss. Twelve new superconducting elements have been discovered, one third of all those known. Ferroelectricity and lattice instabilities have been found as a major obstacle to much higher transition temperatures. Two entirely new groups of superconducting compounds have been discovered. F-electron superconductivity has been detected making lanthanum superconducting above 12 degrees K, the highest of all elements. Two new theories have been published.
Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-16681# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PREVISION OF UNSTABLE OPERATION DOMAINS OF SOLID PROPELLANT ROCKET MOTORS
Marcel Barrere and Lionel Nadaud 1971 19 p refs In FRENCH; ENGLISH summary Presented at the 22d Intern. Congr. on Astronaut., Brussells, 20-25 Sep. 1971
(ONERA-TP-1016) Avail: NTIS

The methods for determining the propellant response function are described: they make use either of already unstable motors (L* or T-shaped), or of modulated exhaust, the pressure fluctuation being obtained through a periodic variation of the nozzle throat section. The drawback of the methods based on unstable motors is that they are limited to a narrow operating range; their development, however, permits the parameters governing the motor response to be known, and in a particular, its real part. The modulated exhaust technique opens the study to a large frequency range and leads to a simple evaluation of the transfer function. The results obtained with these techniques and their validity domain are discussed. This discussion is based on a linearized theory showing that the response function of the surface depends on two parameters linked to the pyrolysis kinetics and to the energy available at the surface. This linearized theory, however, is unable to predict correctly the propellant response. The prediction of the motor stability domains from the above mentioned results is possible when the losses in the configuration considered for the motor can be evaluated. Author

N72-16682# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
INVESTIGATIONS OF LIQUID PROPELLANT SYSTEMS WITH COMPENSATED OXYGEN BALANCE [UNTERSUCHUNGEN VON FLUESSIGEN TREIBSTOFFSYSTEMEN MIT AUSGEGLICHENER SAUERSTOFFBILANZ]
R. Dautel 31 Jan. 1971 35 p In GERMAN
(ICT-1/71) Avail: NTIS

Theoretical and experimental investigations have been carried out on twelve bi-propellant systems with equalized oxygen balance. Reaction operations have been established from which heat of reaction and specific gas volume as well as mixture ratio of components in the system have been computed. The heat of reaction as well as the maximum pressure and time of rise of the gases in the system have been determined experimentally. Results are discussed. ESRO

N72-16683# Institut fuer Chemie der Treibstoffe, Berghausen (West Germany).
INFLUENCE OF GRAIN SIZE ON THE COMBUSTION SPEED OF SOLID AMMONIUM PERCHLORATE PROPELLANTS [EINFLUSS DER KORNGROESSE AUF DIE ABBRANDGESCHWINDIGKEIT AMMONIUMPERCHLORATHALTIGER FESTTREIBSTOFFE]
H. Pfoertner 25 Oct. 1971 46 p refs In GERMAN
(ICT-3/71) Avail: NTIS

The influence of the grain size of the incorporated oxidizer on the combustion velocity under pressure in the 20 to 130 atm range is discussed using ammonium perchlorate/polyurethane solid propellant as an example. The mean grain size is changed from 10 to 200 micrometers by monodispersal and the results are discussed. ESRO

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-16684 National Lending Library for Science and Technology, Boston Spa (England).
A NEW RADIOACTIVE MEASURING PROCEDURE FOR THE CONTINUOUS DETERMINATION OF THE OIL CONSUMPTION OF GASOLINE ENGINES
M. Fock 15 Sep. 1971 17 p refs Transl. into ENGLISH from Automobiltechnische Z. (W. Germany), v. 73, no. 3, Mar. 1971 p 75-79
(NLL-Trans-1179-(9022.9)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

For determining the oil consumption of gasoline engines, a radioactive measuring procedure using oil labelled with tritium was developed. A fraction of the engine exhaust gas is led through a proportional counting tube, by means of which the tritium concentration of the combustion products is estimated continuously. This measured indication is proportional to the oil consumption. With this procedure, both constant-speed and variable-speed regimes of running can be investigated. Author

N72-16685# Advisory Group for Aerospace Research and Development, Paris (France).
INLETS AND NOZZLES FOR AEROSPACE ENGINES
Dec. 1971 503 p refs Partly in ENGLISH and FRENCH Presented at the 38th Meeting of AGARD Propulsion and Energetics Panel, Sandefjord, Norway, 13-17 Sep. 1971
(AGARD-CP-91-71; UDC-533.697) Avail: NTIS HC $6.00/MF $0.95

Conference papers are presented on five topics: engine-airplane interference representation in wind tunnel testing; thrust vectoring and control; V/STOL inlets and nozzles; supersonic inlets, nozzles, and applications; and subsonic and transonic aeropropulsion. For individual titles, see N72-16686 through N72-16718.

N72-16686# New York Univ., N.Y. Aerospace Lab.
REVIEW OF THE CONCLUSIONS OF THE AGARD AD HOC COMMITTEE ON ENGINE AIRPLANE INTERFERENCE AND WALL CORRECTIONS IN TRANSONIC WIND TUNNEL TESTS **c01**
Antonio Ferri *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 10 p (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

A program for the study of problems of engine-airplane interference is outlined. Engine simulators, nozzle design, and dynamic characteristics of the inlet are considered. K.P.D.

N72-16687# National Aerospace Lab., Amsterdam (Netherlands).
INLETS-AIRPLANE TESTING IN TRANSONIC WIND TUNNELS **c01**
F. Jaarsma *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The results and recommendations on inlet testing in transonic wind tunnels are discussed in detail. Special attention is directed towards mass flow measurements, external drag determination, boundary layer representation for diverters and bleeds, and non-steady flow phenomena in inlets. Author

N72-16688# Naval Postgraduate School, Monterey, Calif.
NOZZLE AND EXHAUST TESTING IN TRANSONIC FLIGHT REGIME **c01**

Allen E. Fuhs *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 32 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

A survey of engine-airframe interference is presented. In the early stages of development, wind tunnel tests of nozzles and exhausts were conducted, both alone and in models of the afterbody. Thrust measurements were made in test facilities at sea level and various altitudes, followed by flight tests. Drag (of nozzle, boattail, etc.) was determined, as well as thrust. Simulation of exhaust of hot and cold gases, ejectors, and powered simulators is an important facet of testing. Nonsteady aerodynamics of internal and external flow and aeroelastic phenomena need to be examined. These topics are discussed for both podded and buried engines. Major conclusions of the study related to exhausts and nozzles are given. Author

N72-16689# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PROBLEMS OF MEASUREMENT ON MODEL OF THE THRUST OF A SUPERSONIC AIRCRAFT AFTER-BODY STANDARD NOZZLES c01
Bernard Masure *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

A technique for wind tunnel measurement, through an upstream cylindrical strut, of the thrust of an afterbody is described. With this measurement it is possible to correct the global measurements made on complete models with simplified hollow nacelles. Precision is checked by various calibrations including tests on a standard convergent-divergent nozzle. Checking and analyzing of results for complex configurations, including a primary convergent nozzle, are based on knowledge of mass flow rates and thrusts of corresponding sonic nozzles. Data concerning such nozzles result from precise tests performed within the atmosphere, without external flow, for a wide variety of shapes. The results are presented and compared with theoretical data. Author

N72-16690# Centre d'Essais de Propulseurs, Saclay (France).
TEST METHODS AND EXAMPLES FROM THE PROPULSION TEST CENTER c11
Jean-Claude Ripoll and Jean-Bernard Cocheteux *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 17 p In FRENCH (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The Propulsion Test Center is a French government establishment which participates in the development of aeronautical engines, using industrial test methods of flight simulation. Equipment at the facility includes principally exhaust air and gas treatment apparatus (using either electricity or vapor), a complex network of conduits, 8 engine test cells for flight simulation, and 7 test jets. Measurements are controlled by a central coordinator. Among tests made on air inlets and nozzles, tests on the Concorde aircraft are noted, as well as those on noise and thrust. Transl. by K.P.D

N72-16691# National Gas Turbine Establishment, Farnborough (England).
MEASUREMENT FULL-SCALE OF PROPELLING NOZZLE PERFORMANCE IN AN ATTITUDE TEST FACILITY c01
J. C. Ascough *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

Full scale thrust performance tests are described which were made in an altitude test cell on a prototype two-stream propelling nozzle fitted to a turbojet engine installed within a simulated aircraft nacelle. The tests were made at conditions representing flight at Mach 2 at 20 km altitude. Nozzle thrust efficiency obtained from these full scale tests was compared with that from a 1/10 scale model test rig. The preliminary analysis gave unexpectedly low full scale efficiencies and, to investigate this, special tests were made with the secondary part of the nozzle removed. As a result of the primary nozzle tests, corrections were made to secondary nozzle test points, which yielded satisfactory agreement between full scale and model. Author

N72-16692*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLET-ENGINE-NOZZLE WIND TUNNEL TEST TECHNIQUES c12
D. N. Bowditch *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 16 p refs (See N72-16685 07-28)
(NASA-TM-X-67494) Avail: NTIS CSCL 20D

Experimental investigations of the inlet, engine, and exhaust nozzle of a supersonic propulsion system are described. Exhaust nozzle results are presented which are compared with wind tunnel and flight results to assess the accuracy of flight measurements. Comparisons are also presented for nozzle performance obtained with a cold jet, a powered turbojet simulator, and a solid jet boundary simulator. The effect of the local boundary layer on nozzle performance is also discussed. The need for good dynamic measurements during inlet-engine testing is illustrated for transients such as inlet unstart and engine stall. The transient nature of inlet distortion and its effect on the engine are presented for two different operating conditions. Author

N72-16693# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
WIND TUNNEL TESTING OF V/STOL ENGINE MODELS: SOME OBSERVED FLOW INTERACTION AND TUNNEL EFFECTS
R. A. Tyler and R. G. Williamson *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The interpretation of force measurements on V/STOL-related models incorporating inflows and/or outflows is discussed in relation to investigations concerned mainly with the transition performance of lift fan configurations. These utilize balance-mounted, powered models of about 1000 hp in the closed test section of a 10 ft x 20 ft V/STOL propulsion tunnel. With models producing strong downwash, an overriding testing limit arises in closed wind tunnels from the formation of a stable floor vortex system due to the interaction of stagnating model flow with the mainstream. An experimental study of this effect as it relates to downward directed jets is described. Vortex formation limits are correlated in terms of a jet force coefficient for a wide range of jet inclinations to the vertical, and for both single and paired jets. Interference velocity measurements, with limited data from the main program and other sources, are used to deduce corresponding tunnel flow breakdown limits. These testing limits are shown to be sensitive to model characteristics. Author

N72-16694# LTV Aerospace Corp., Dallas, Tex.
VECTORED THRUST IN AIR COMBAT
C. R. James *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 8 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

Advantages of thrust vectoring in air combat are evaluated using a manned air combat simulator. This simulator consists of two fighter cockpits linked by digital computer-driven visual displays which present each pilot with a properly oriented image of the opponent aircraft. Real time digital computation permits each pilot to fly his aircraft anywhere within the performance and strength limits of the airframe as he strives to maneuver into position to fire his weapons. Engagements include three cases: (1) a baseline conventional fighter, (2) a vectored thrust version of the baseline, and (3) the vectored thrust configuration with a 1500-pound weight penalty. The conventional fighter is the common opponent for all engagements. Engagements are scored by relative time in advantageous positions and by win-lose-draw results. Advantages of thrust vectoring are quantified and the

sensitivity of advantages to weight penalty is determined. The experiments are described, results are summarized and analyses presented based on aircraft performance parameters. Results are also correlated with previous experiments. Author

N72-16695# Motoren-Und Turbinen-Union Muenchen G.m.b.H. (West Germany).
AERODYNAMICS OF THRUST REVERSER DESIGN c01
W. J. Lewis (Rolls-Royce, Ltd., Bristol, Engl.) and H. Prechter *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 11 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

For a number of applications the clamshell target-type thrust reverser is an attractive solution for producing a braking force from a jet engine. This type of reverser consists of a pair of buckets which, in the stowed position, form part of the aircraft fuselage or engine nacelle and are moved into the jet efflux downstream from the final nozzle to provide thrust reversal. The important geometric design parameters can be determined from consideration of the flow in the thrust reverser system. Their effect on the aerodynamic performance was established from model tests and is discussed in detail. For the optimization of the operating mechanism in connection with fail-safe requirements, the load on the bucket and its point of application is important and is related to the reverser geometry. The problem of hot gas and debris ingestion into the engine intake is pointed out. Several solutions to overcome this problem are investigated, together with the implications they have for performance and design. Author

N72-16696# Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Villaroche (France).
INFLUENCE OF CERTAIN CHARACTERISTIC PARAMETERS ON EJECTOR PERFORMANCE
Jean Marie Hardy *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs In FRENCH (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The optimization parameters for the adaptation of an afterbody are presented and the principles of the theoretical calculation method for ejector performance are considered. A study of the effects of geometric parameters on internal and external nozzle performance is reviewed, based on the results of theoretical and experimental calculations. The internal adaptation of the ejector was investigated, as well as the choice of position for secondary ventilation, considering the effect of hot gas. Optimization of global performance by choosing the value and form of the ejector section are also presented. Several theoretical and experimental results are given. Transl. by K.P.D.

N72-16697# Royal Aircraft Establishment, Bedford (England).
SOME APPLICATIONS OF BOUNDARY-LAYER CONTROL BY BLOWING TO AIR INLETS FOR V/STOL AIRCRAFT c02
I. McGregor *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 13 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The use of jet blowing as a means of boundary layer control in intakes appears to have several advantages for V/STOL aircraft. The principles involved are discussed, giving two examples: a two-dimensional inlet under static conditions, and a ducted lifting fan at low forward speed. Some results of the effects of slot blowing on the behavior of the intakes of a model of a V/STOL strike aircraft at subsonic speeds are presented, and compared with those obtained using a naturally-aspirated suction bleed. It is concluded that boundary layer control by blowing could lead to a small improvement in net thrust and a significant reduction in flow distortion at entry to the compressor. Sensitivity of intake performance to incidence is also much reduced. Author

N72-16698*# De Havilland Aircraft Co., Ltd., Downsview (Ontario).
SOME ASPECTS OF PROPULSION FOR THE AUGMENTOR-WING CONCEPT
D. C. Whittley *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 14 p refs Sponsored in part by NASA, Defence Res. Board of Canada, and Canadian Dept. of Ind. (See N72-16685 07-28)
(NASA-CR-125540) Avail: NTIS CSCL 21E

Many modern concepts for STOL and V/STOL aircraft rely on integration of the propulsion system with the wing to create favorable lift interactions, and are known as powered lift concepts. A study of powered lift, concerning management and control of the various propulsive streams or jets is presented, each concept having its own particular objectives and requirements. Some specific objectives of this kind are described which relate to the augmentor wing. Consideration is given to three aspects of the subject, namely the augmentor flap itself, the wind ducting and augmentor primary nozzle, and the choice of powerplant or engine cycle. More generally, comments are made regarding noise attenuation and the prospect for achieving a low overall noise level for jet-STOL aircraft of the future. Author

N72-16699# Rolls-Royce, Ltd., Derby (England). Engine Div.
RAPID MIXING NOZZLES FOR V/STOL APPLICATIONS c02
C. M. Chesters *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 11 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

If the maximum potential of a V/STOL aircraft is to be achieved, it must be capable of operating from a variety of both prepared and unprepared sites. The use of high thrust-to-weight ratio jet lift engines with convergent or annular nozzles restricts this capability due to ground erosion, debris and hot gas recirculation, and noise. Model and full scale tests demonstrated the benefits to be obtained from the use of rapid mixing nozzles with acceptable thrust lost and engine length penalties. The scope of the investigation extended to an examination of the possibilities of thrust vectoring and of the performance of thrust augmentors using rapid mixing nozzles. Author

N72-16700# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Luftsaugende Antriebe Eng. Dec. 1971 10 p
THE PROPULSION JET OF A VTOL AIRCRAFT
E. Schwantes *In* AGARD Inlets and Nozzles for Aerospace refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The three regions of a vertical takeoff propulsion jet (the free jet, the wall jet and the zone of separation of the wall jet from the ground due to wind effects and buoyancy forces) were investigated with a three-dimensional model jet. Behind the convergent nozzle the jet accelerates up to supersonic velocity maintaining the core nearly five nozzle diameters. Because of the lower turbulence of the jet with high speed, jet decay and the three-dimensional spread are lower than those of the jet with small nozzle velocity. At the hot wall jet there is a strong influence of nozzle distance from the ground on velocity profile. The decisive parameter characterizing the recirculation flow is the radius of separation of the wall jet from the ground. The behavior of the radius of separation for different jet parameters and several wind velocities is presented. Author

N72-16701# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).
FLOW ANALYSIS IN AXISYMMETRIC SUBSONIC INLETS OF SMALL GAS TURBINES
P. M. Gallet *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs Prepared in cooperation with Ecole Royale Militaire (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

Complicated axisymmetric air inlets are used in small gas

turbines, thus disturbing the flow at the compressor entrance. A streamline curvature method to calculate the flow in the passage and at the compressor eye is presented. A universal theory of the discontinuities of curvature was applied. Additional annulus boundary layer calculations may help in the analysis of a channel. Some experimental and theoretical results are shown, which tend to confirm the validity of the theory. Author

N72-16702# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
FLOW DISTORTION AND PERFORMANCE MEASUREMENTS ON A 12 INCH FAN-IN-WING MODEL FOR A RANGE OF FORWARD SPEEDS AND ANGLE OF ATTACK SETTINGS **c01**
Uwe W. Schaub and Robert W. Bassett *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 13 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The model, comprising a 12-in. diameter fan buried in a N.A.C.A. 0015 section wing with a constant chord of 40-in., was tested at various angles of attack and air speeds in the 10x20-ft closed propulsion wind tunnel. Tunnel interference corrections were estimated. Typical corrections were indicated for the whole testing range which became limited at very low crossflow ratios as a result of uncertainty in the correction in angle of attack. Flow distortion due to crossflow occurred in both the inlet and exit planes. In the crossflow ratio range zero to 0.27, inflow distortion was observed to be velocity distortion at essentially constant total pressure, whereas outflow distortion appeared to be a distortion of the exit plane static pressure field. Author

N72-16703# Boeing Co., Seattle, Wash.
THE DESIGN, DEVELOPMENT, AND TESTING OF A SUPERSONIC TRANSPORT INTAKE SYSTEM **c02**
E. Tjonneland *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 17 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The performance criteria, including engine airflow matching requirements, of an axisymmetric mixed-compression intake for a supersonic transport application are described and related to the selection of the design features of the intake variable-geometry components. Viscous technology is applied to the design and development of the boundary layer control system to account for intake viscous interactions and to scale model results to full-scale designs. Small, low-angle bleed holes 20 deg to the surface yield high flow coefficients. Hole diameters of approximately half the height of the boundary layer displacement thickness are used to improve the cleanliness of the supersonic diffuser flow and to maximize pressure recovery of the bleed air. Vortex valves are incorporated in a fluidic normal shock stability system to allow operation at peak intake recovery and remain started during atmospheric or engine transients. Author

N72-16704# National Gas Turbine Establishment, Pyestock (England). Engine Test Dept.
FREE-JET TESTS OF A FULL SCALE SUPERSONIC INTAKE/ENGINE COMBINATION **c02**
P. F. Ashwood *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 19 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

Results are presented from an experimental investigation on a full-scale Concorde power plant in 5 ft x 5 ft free-jet test facility to investigate intake/engine compatibility at supersonic speeds under both steady-state and transient conditions. The main aim of the test program was to study the behavior of the power plant when running under the control of its flight systems, in particular during the transients that result from the sudden application of side-slip or from rapid engine power changes. Initial tests with the intake alone enabled surveys to be made of the engine face pressure distribution and fluctuation over a wide range of test conditions. The major part of the program was undertaken with an Olympus 593 two-spool turbojet engine coupled to the intake in a test configuration which reproduced the precise geometry of the port outer power plant of the prototype Concorde aircraft. Author

N72-16705# British Aircraft Corp., Filton (England). Commercial Aircraft Div.
CONCORDE POWERPLANT DEVELOPMENT
C. S. Leyman and D. P. Morriss *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 32 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The development of the Concorde power unit is described, with particular reference to the problems encountered during flight testing. The extent to which these problems were predicted by altitude test cell experience and the use of such facilities in the development of the design are also discussed. Author

N72-16706# Boeing Co., Seattle, Wash.
CONTROL CONCEPT AND WIND TUNNEL TESTING OF A SUPERSONIC INTAKE CONTROL SYSTEM **c02**
H. N. Larsen and R. G. Schweikhardt *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 23 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The controller is independent of other intake controllers and of airplane data systems. During started intake operation, throat Mach number is controlled with a translating centerbody and variable position cowl throat doors; normal shock position is controlled with secondary air valves and overboard bypass doors. These two control loops use intake duct pressure ratio signals for feedback. The desired pressure ratio reference value is scheduled with centerbody position and biased with intake controller error signals to provide for varying intake Mach number and angle of sideslip. Using vortex valves as an auxiliary normal shock stability system, model tests showed that the controller can maintain peak intake recovery while accommodating the required disturbances. Hot- and cold-day engine/intake air flow matching is automatically controlled with increased secondary valve air flow or an intake-activated engine rpm trim control. An external compression mode which maintains stable intake air flow with low compressor face distortion provides for unstarted supersonic intake operation. Author

N72-16707# General Dynamics/Fort Worth, Tex. Convair Aerospace Div.
AN AERODYNAMIC DRAG STUDY OF JET ENGINE NOZZLES
Dave Bergman *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

To aid nozzle analysis in areas where analytical methods are lacking, a wind tunnel program was conducted to investigate and measure the external drag characteristics of several nozzles at both on- and off-design exhaust conditions. This study involves nozzles of the centerbody plug, the convergent, and the convergent-divergent types. Flow-through-nacelle nozzles and solid-wall jet plume simulators, each used frequently in airplane model tests, were included in the program. Results show large changes in external drag with variations in exhaust flow, and describe the behavior of jet plume shape and entrainment effects. The results also provide insight into methods for simulating exhaust flow effects on airplane models which do not incorporate high-pressure exhaust flow. Author

N72-16708# British Aircraft Corp., Preston (England).
JET EFFECTS ON BOATTAIL PRESSURE DRAG AT SUPERSONIC SPEEDS **c01**
J. A. P. Stoddart *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 11 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

An analysis is presented of supersonic boattail pressure drag measurements in the presence of single or twin propulsive

jets. Using theoretical inviscid pressure distributions as a datum, the decrease in boattail pressure drag coefficient with increasing nozzle pressure ratio is shown to be a function of the difference between the measured base pressure coefficient and a reference base pressure coefficient. The boattail shapes are shown to fall into two groups, one of which experiences a much stronger influence of the propulsive jet than does the other. Correlations of measured base pressure coefficient in the presence of a propulsive jet are also presented for convergent and con-di nozzles. Author

N72-16709*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A FLIGHT INVESTIGATION OF STEADY STATE AND DYNAMIC PRESSURE PHENOMENA IN THE AIR INLETS OF SUPERSONIC AIRCRAFT c12
Frank W. Burcham, Jr. and Donald R. Bellman *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs (See N72-16685 07-28)
(NASA-TM-X-67495) Avail: NTIS CSCL 20D

The difficulty of achieving adequate inlet performance and stability and avoiding engine compressor stalls at supersonic speeds has led to the investigation of pressure phenomena in the inlets of several supersonic aircraft. Results of tests with the F-111A airplane are presented showing the inlet steady state and dynamic performance. The inlet total pressure distortion that causes compressor stall is discussed, and the requirement for high response instrumentation is demonstrated. A duct resonance encountered at Mach numbers near 2.0 is analyzed and shown to be due to a normal shock oscillation at the duct fundamental frequency. Another type of resonance, in the engine fan duct, is shown to be a possible cause of reduced engine stall margin in afterburning operation. Plans for a comprehensive inlet study of the YF-12 airplane are discussed including flight tests and full scale, 1/3 scale, and 1/12 scale wind tunnel tests. Author

N72-16710# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SUPERSONIC INLET PERFORMANCE AND DISTORTION DURING MANEUVERING FLIGHT c02
L. E. Surber and D. J. Stava *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 18 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

Several possible vehicle configurations are presented and discussed to point out inherent advantages and disadvantages in terms of airframe-inlet integration and mission accomplishment. Features of the forebody and forebody/wing configurations are presented, together with wind tunnel test data comparing the inlet flow fields of these models. Techniques are described for design air inlets for the airframe flow fields. It also describes the instrumentation employed to document inlet performance. Air inlet performance and duct flow distortion from wind tunnel tests of different model designs are compared to show the effects of aircraft geometry, air inlet design, and maneuver condition over the 0.6 to 2.5 Mach number range. Author

N72-16711# Pratt and Whitney Aircraft, West Palm Beach, Fla.
INLET-ENGINE COMPATIBILITY ANALYSIS
S. H. Ellis *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 10 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The destabilizing factors considered in compatibility analysis are reviewed; instrumentation and test techniques are discussed; and examples of compatibility data are given for a propulsion system consisting of a supersonic inlet and a turbofan engine. The primary destabilizing factor, inlet distortion, is measured with high response instrumentation capable of describing complex time-variant distortion patterns. The maximum-time variant distortions, determined from model inlet tests, are simulated during component and engine testing to define both loss in stall margin with distortion and the attenuation of distortion as it passes through the engine. The losses in stall margin due to engine causes, such as throttle transients, control tolerances and component interactions, are analyzed by dynamic simulations to identify potential system problems prior to system testing. Attention is focused on potential problems by compatibility audits that show the allocation of stall margin between destabilizing influences and identify areas where component improvement is needed. Author

N72-16712# Politecnico di Milano (Italy). Ist di Macchine.
ON THE APPLICATION OF A TIME DEPENDENT TECHNIQUE IN TRANSONIC DOUBLE FLOW NOZZLE SOLUTIONS c12
Carlo Osnaghi and Ennio Macchi *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 15 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

A computer program was written, which was able to solve axisymmetric, inviscid flows contemporarily, irrespective of their subsonic, transonic, or supersonic nature. Some results relating to a transonic nozzle and a subsonic double flow nozzle are presented and compared with experimental data. Author

N72-16713# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
VELOCITY DISTRIBUTION AT A SUPERSONIC COMPRESSOR INLET c12
Bernard Ledoux and Roger Bagot *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 10 p In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

A direct method is derived in which the ideal, compressible flow in the duct is established from the duct and the cowl shapes. The computed pressure distributions are compared with those on the external shroud and cowl during wind tunnel tests. The velocity distribution in the duct is deducted. An indirect method is also presented, starting from the pressure distribution on the external wall and leading to the flow field. The calculation is checked by comparing the streamline corresponding to the set-up inlet with the front cowl meridian shape. Author

N72-16714# A.S. Kongsberg Vapenfabrikk (Norway). Gas Turbine Div.
THE ANALYSIS OF A SUBSONIC AXISYMMETRIC INLET FOR COMPRESSOR MATCHING c12
R. E. Stanley *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 13 p ref (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

The measured velocity distribution for the original inlet is compared to the distribution obtained by a method of numerical analysis. It is shown that the favorable results of this comparison led to the development of the inlet by a method of numerical analysis in preference to a model testing technique. The recommendations are presented, together with the results of an experimental analysis of the redesigned inlet configuration. The method of compressor matching is touched upon. Author

N72-16715# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STARTING CONDITIONS OF A MIXED COMPRESSION AXISYMMETRIC HYPERSONIC INLET c12
G. Laruelle and J. Leynaert *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 9 p refs In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

An improved diagram including an elementary representation of the interaction phenomenon is used. By means of this diagram, test data on axisymmetrical inlets at high supersonic speeds are discussed, and the influences of some parameters are calculated. Author

N72-16716# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THEORETICAL AND EXPERIMENTAL STUDY OF THE COEXISTENCE OF TWO TYPES OF FLOW IN A CHANNEL WITH CONSTANT CROSS SECTION c12
Jacques Paulon *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p refs In FRENCH; ENGLISH summary (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

A two-dimensional and an asymmetrical set-up of very similar characteristics, were built to study the coexistence, in a constant section duct, of a supersonic jet inside a subsonic jet. The experimental analysis of the flow, made from pressure readings on the walls and inside the fluid, led to characterizing the actual limits of the two flows, and also the transition domain between them. In the two-dimensional case, the schlieren visualization of the flow confirms the measurements. The theoretical analysis, based on the method of characteristics, confirms the parietal readings. The maximum flaring section differs from the sonic section of the external flow, which may lead to faulty predictions in the case of a contoured ejector.
Author

N72-16717# Technische Hochschule Aachen (West Germany). Inst. fuer Strahlantriebe und Turboarbeitsmaschinen.
A NEW CONCEPT OF THE INLET DESIGN AND OF THE THERMODYNAMIC CYCLE OF THE TURBOJET ENGINE AT HIGH FLIGHT MACH NUMBERS
W. Dettmering and B. Becker *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 10 p refs (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

At high supersonic speeds the efficiency of the inlet strongly depends on the diminution of the Mach number before the normal shock. Theoretical investigations show that this deceleration can be increased by replacing the internal compression in the bladeless channel by a supersonic rotor. Due to the deceleration of the relative flow and the increase of the circumferential velocity from rotor inlet to outlet, a significant augmentation of the static pressure ratio is achieved. Moreover, the Mach number can be decreased by the transfer of mechanical energy to the rotor. After the transition to subsonic velocities in the stator, the energy was returned to the flow either by a conventional compressor, or by a second supersonic rotor accelerating the flow between the combustion chamber and the nozzle. Static pressures and temperatures in this turbojet engine, which operates with subsonic combustion, are comparable to those of the supersonic combustion ramjet.
Author

N72-16718# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).
WIND TUNNEL INVESTIGATIONS OF A SUPERSONIC AIR INTAKE WITH VARIOUS AUXILIARY INTAKES AT LOW SPEEDS c12
Herbert Eibl and Reinhard Friedrichs (DFVLR, Brunswick) *In* AGARD Inlets and Nozzles for Aerospace Eng. Dec. 1971 12 p (See N72-16685 07-28)
Avail: NTIS HC $6.00/MF $0.95

In the low-speed tunnel, model tests were carried out on a twin-engine aircraft configuration with air intakes located on the upper side of the fuselage next to the trailing edge of the wing. The measurements refer to the flow field in the compressor inlet area of a supersonic intake at which the influence of auxiliary intakes of different shapes were investigated. The results are presented as isobars of the total pressure distribution in the compressor inlet area. The pressure loss and distortion parameters are discussed, strongly dependent on the inflow incidence and on the intake flow mainstream ratio.
Author

N72-16719*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA QUIET ENGINE PROGRAM
James J. Kramer and Francis J. Montegani 1972 25 p refs Proposed for presentation at the 17th Ann. Intern. Gas Turbine Meeting, San Francisco, 26-30 Mar. 1972; sponsored by ASME (NASA-TM-X-67988; E-6729) Avail: NTIS CSCL 21E

Initial studies on the design and testing of the quiet engine are described. The principal noise sources considered in the engine selection were the fan machinery noise and the fan and core jet noise. Nacelle acoustic linings are also mentioned. Fan and engine tests are discussed briefly and results indicate that it is possible to achieve or exceed noise reduction objectives of 15 to 20 PNdb below the levels of 707/DC-8 long-range transport aircraft.
N.E.N.

N72-16720*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMIC FLOW ANGLE MEASUREMENTS AT THE DIFFUSER EXIT OF A MACH 2.5 MIXED COMPRESSION INLET
William M. Prati and James E. Calogeras Washington Feb. 1972 17 p refs
(NASA-TM-X-2497; E-6606) Avail: NTIS CSCL 21E

An exploratory investigation was made to determine the magnitude of the dynamic flow angle at a single point in the diffuser exit of a Mach 2.50 inlet. Results indicate that the maximum flow angle variation was + or - 3 degrees except when vortex generators were installed in the subsonic diffuser. The amplitude of these flow angle fluctuations was directly related to the amplitude of the total pressure fluctuations at the probe survey point. Flow angle fluctuations as high as + or - 11 degrees were recorded when vortex generators were installed near the probe survey point.
Author

N72-16721*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF OPERATING CONDITIONS ON THE EXHAUST EMISSIONS FROM A GAS TURBINE COMBUSTOR
Daniel Briehl, Leonidas Papathakos, and Richard J. Strancar Washington Feb. 1972 54 p refs
(NASA-TN-D-6661; E-6432) Avail: NTIS CSCL 21E

Exhaust concentrations of total unburned hydrocarbons, carbon monoxide, and nitric oxide were measured from a single J-57 combustor liner installed in a 30 diameter test section. Tests were conducted over a range of inlet total pressures from 1 to 20 atmospheres, inlet total temperatures from 310 to 590 K, reference velocities from 8 to m/sec, and fuel-air ratios from 0.004 to 0.015. Most of the data were obtained using ASTM A-1 fuel; however, a limited number of tests was performed with natural gas fuel. Combustion efficiency and emission levels are correlated with operating conditions. Sampling error at operating conditions for which combustion efficiency was below about 90 percent resulted in abnormally low readings for hydrocarbon emissions.
Author

N72-16722*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERALIZED SIMULATION TECHNIQUE FOR TURBOJET ENGINE SYSTEM ANALYSIS
Kurk Seldner, James R. Mihaloew, and Ronald J. Blaha Washington Feb. 1972 66 p refs
(NASA-TN-D-6610; E-5998) Avail: NTIS CSCL 21E

A nonlinear analog simulation of a turbojet engine was developed. The purpose of the study was to establish simulation techniques applicable to propulsion system dynamics and controls research. A schematic model was derived from a physical description of a J85-13 turbojet engine. Basic conservation equations were applied to each component along with their individual performance characteristics to derive a mathematical representation. The simulation was mechanized on an analog computer. The simulation was verified in both steady-state and dynamic modes by comparing analytical results with experimental data obtained from tests performed at the Lewis Research Center with a J85-13 engine. In addition, comparison was also made with performance data obtained from the engine manufacturer. The comparisons established the validity of the simulation technique.
Author

N72-16723*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A BICONE INLET DESIGNED FOR MACH 2.5 WITH INTERNAL DISTRIBUTED COMPRESSION AND 40 PERCENT INTERNAL CONTRACTION
Joseph F. Wasserbauer and David A. Choby Washington Feb. 1972 68 p refs
(NASA-TM-X-2416; E-6579) Avail: NTIS CSCL 21E

The inlet was designed to have the minimum internal contraction consistent with high total-pressure recovery and low cowl drag. Without a bypass system, the peak pressure recoveries increased from 0.890 to 0.936 when the supercritical bleed mass flow ratio was varied from 0.035 to 0.060. With an operating bypass system and installed centerbody vortex generators, a slight increase in peak pressure recovery was obtained. The values of steady-state distortion and dynamic distortion were below 0.10 and 0.02, respectively, near critical operation. Simulation of a turbofan engine with concentric pipes showed no effect on compressor face flow profiles with varying bypass flow ratio. Author

N72-16724*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF TWO TYPES OF HELIUM CIRCULATORS ON THE PERFORMANCE OF A SUBSONIC NUCLEAR POWERED AIRPLANE
William C. Strack Washington Mar. 1971 29 p refs
(NASA-TM-X-2237; E-5811) Avail: NTIS CSCL 21F

Two types of helium circulators are analytically compared on the bases of their influence on airplane payload and on propulsion system variables. One type of circulator is driven by the turbofan engines with power takeoff shafting while the other, a turbocirculator, is powered by a turbine placed in the helium loop between the nuclear reactor and the helium-to-air heat exchangers inside the engines. Typical results show that the turbocirculator yields more payload for circulator efficiencies greater than 0.82. Optimum engine and heat exchanger temperatures and pressures are significantly lower in the turbocirculator case compared to the engine-driven circulator scheme. Author

N72-16725# Royal Aircraft Establishment, Farnborough (England).
AN INVESTIGATION OF A COMBINED DISCHARGE TRIGGERING AND PROPELLANT INJECTION SYSTEM FOR USE IN A RAIL THRUSTER
T. J. Punter and D. G. Fearn Feb. 1971 49 p refs
(RAE-TR-71027) Avail: NTIS

An investigation into the behavior of a combined triggering and propellant injection system for use in a pulsed plasma rail thruster, operating on mercury, is described. The thruster is intended to produce a mean force of 0.0005 N, controllable by alternating the pulse repetition frequency, and is triggered by a discharge from a tungsten pin to a nearby mercury meniscus. It was found that this system was adequate for experimental work, but insufficiently reliable for operational use. Some alternative triggering systems are also described. Author (ESRO)

N72-16726# Bath Univ. of Technology (England).
A SYSTEMATIC APPROACH TO THE DESIGN OF RADIAL INFLOW AND MIXED FLOW TURBINES
F. J. Wallace London Aeron. Res. Council 1971 31 p refs Supersedes ARC-32781
(ARC-CP-1180; ARC-32781) Avail: NTIS; HMSO: 52p; PHI: $2.25

Three aspects of the problems encountered in turbine design are examined. They are (1) a simplified one-dimensional steady flow treatment for performance predictions on simple and multiple admission turbines including the case of nozzle or rotor choking; (2) a one-dimensional unsteady flow treatment for the prediction of pulse performance, again for single and multiple admission casings; and (3) a brief discussion of pseudo three-dimensional streamline curvature techniques which were extended to include automatic computer plotting of streamlines, isobars, and isotachs, as well as of the rotor geometry itself. Author (ESRO)

N72-16727# Royal Aircraft Establishment, Farnborough (England).
THE RAE 10cm HOLLOW CATHODE MERCURY THRUSTER
B. P. Day and R. Hastings Jun. 1971 27 p refs
(RAE-TR-71135) Avail: NTIS

The performance of the electron bombardment mercury ion engine is discussed. Results are given which show how, at 80% utilization efficiency, the discharge losses are reduced from 540 to 260 eV/ion by increasing the grid open area ratio from 50% to 75%. The effect of mass flow rate and magnetic field strength on performance is also shown. Thermal time constants and the effect of hollow cathode flow rate on discharge potential are given and their implications are discussed in connection with engine control. Author (ESRO)

N72-16728# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIRST FLIGHT TESTS OF RAMJET ENGINES
Yu. A. Pobedonostsev 17 Aug. 1971 25 p refs Transl. into ENGLISH from Hist. of Rockets and Astronaut., 18th Intern. Astronaut. Congr., Belgrade, 25-29 Sep. 1967 p 109-121
(Contract F33657-71-D-0057; Proj. JCR-AAH9; DIA-Task-T65-04-19A)
(AD-732275; FTD-AC-23-735-71) Avail: NTIS CSCL 21/8

The report presents a brief history of ramjet engines. GRA

N72-16729# Sheffield Univ. (England). Dept. of Fuel Technology and Chemical Engineering.
SWIRLING HYDROGEN JET MIXING WITH A COAXIAL AIR STREAM
Christopher Trotter Aug. 1970 127 p refs Sponsored in part by Min. of Technol.
(Grant EOOAR-0071-70; AF Proj. 9711-02)
(AD-731283; HIC-143; AFOSR-71-2637TR; Rept-61102F; Rept-681308) Avail: NTIS CSCL 21/5

The report is concerned with the turbulent mixing of hydrogen jets in an axial airstream. The efficiency of mixing of swirling and non-swirling jets in terms of the angle of jet spread, and decay of maximum concentration of jet species is estimated and compared with previous work in this field. A gauge designed and developed to measure the swirl intensity produced by a small diameter injector is described. An expression for estimating the angle of jet spread is suggested and a technique for effecting rapid mixing of hydrogen in a scramjet combustor utilizing several small swirling jet injectors is described. Author (GRA)

N72-16730# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
COMPARISON OF CHEMICAL AND NUCLEAR PROPULSION FOR LUNAR AND CISLUNAR TRANSPORTATION SYSTEMS
Reinald G. Finke and Robert C. Oliver Oct. 1970 29 p refs
(Contract DAHC15-67-C-0011; Task-T-58; Task-T-45)
(AD-731963; P-687; IDA/HQ-70-11847) Avail: NTIS CSCL 22/1

Nuclear (NERVA) solid-core propulsion systems are compared to advanced cryogenic (F2/H2 and O2/H2) chemical propulsion systems for an orbit-to-orbit vehicle operating in the earth-moon space. The orbit-to-orbit vehicle is assumed to use propellants delivered by a reusable earth-to-orbit shuttle (EOS). High-velocity-increment missions (lunar and geostationary orbit) are emphasized. Optimum operating regimes for reusable and expendable chemical and nuclear systems are indicated. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-16731# Institut d'Aeronomie Spatiale de Belgique, Brussels.
KINETIC MODELS OF THE SOLAR WIND
J. Lemaire and M. Scherer 1971 38 p refs Submitted for Publication
(Aeronomica-Acta-A-92) Avail: NTIS

A new kinetic model of the quiet solar wind is presented and compared with earlier exospheric, semikinetic, and hydrodynamic models. With the assumption that the trapped electrons are in thermal equilibrium with those emerging from the barosphere, the electric field distribution is calculated to cancel the electric current and space charge in the exospheric plasma. The bulk velocity, the density, the average electron and proton temperatures, and the energy flux, which are observed at one AU for quiet solar wind conditions, are well represented by such a kinetic model. The average electron temperature is nearly independent of the bulk velocity whereas a positive correlation between the average proton temperature and the bulk velocity is found. Consequently it is suggested that in the interplanetary medium (R > 6R sub s) no external heating mechanism is needed to explain the observed quiet solar wind properties. Finally, the electric field calculations in this kinetic model are found to be in reasonable agreement with the empirical electric field values deduced from observed coronal-density distribution.
Author

N72-16732# Institut d'Aeronomie Spatiale de Belgique, Brussels.
NEW ULTRAVIOLET SOLAR FLUX MEASUREMENTS AT 2000 A USING A BALLOON BORNE INSTRUMENT
M. Ackerman, D. Frimout, and R. Pastiels 1971 6 p refs
(Aeronomica-Acta-A-84) Avail: NTIS

Data on the solar UV flux for the atmospheric optical window at 2000 A are presented. The data were obtained by balloon borne spectrometer.
Author

N72-16733*# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE SUN AND THE IONOSPHERE: SHORT-WAVE SOLAR RADIATION AND ITS EFFECT ON THE IONOSPHERE
G. S. Ivanov-Kholodnyi and G. M. Nikol'skii 1972 374 p refs Transl. into ENGLISH of the publ. "Solntse i Ionosfera: Korotkovolnovoe Izluchenie Solntsa i Ego Vozdeistvie na Ionsoferu" Moscow, Nauka, 1969 Sponsored by NASA and NSF
(NASA-TT-F-654; TT-70-50184) Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The short-wave solar radiation and its interaction with the ionosphere are discussed in detail based on direct rocket and satellite measurements. Spectroheliograms of solar short-wave solar radiation and X-ray emissions are described, and spectral lines in the short wave range are predicted and identified. Ionization and temperature of the solar corona, and temperature and matter distributions in the transitional region between the corona and the chromosphere are studied. The basic types of data observed on ionospheric structure and composition are outlined. Physical processes in the ionosphere include ionization, corpuscular radiation, recombination processes, and photochemical processes. The theory of formation of the ionosphere is also investigated, emphasizing formation below and above 100 km, variation of effective recombination coefficient and formation in the F1 region, ionization of the nocturnal ionosphere, and formation of the F2 region.
N.E.N.

N72-16734# Institute of Nuclear Physics, Cracow (Poland).
MEASUREMENTS OF ENERGY AND FLUX OF COSMIC RAY HADRONS USING AN IONIZATION SPECTROMETER
J. Massalski, Z. Mistygacz, L. Suszycki, and J. Warczewski Feb. 1971 20 p refs
(INP-756/PH) Avail: AEC Depository Libraries

A method for determining the energy of cosmic ray hadrons was elaborated. In this method besides the development of electromagnetic cascades, which is a dominating process, also other processes such as disintegrations of the nuclei of the absorber and charged pi-meson ionization are taken into account. Particles escaping through the bottom of the apparatus, the transition effect: lead-brass (chamber wall), and the geometry of the absorber and detectors are also considered. The method is applied to the determination of energy and flux of cosmic-ray particles registered in an ionization spectrometer installed at the Mount Aragac Laboratory in Armenia (3250 m above sea level).
Author (NSA)

N72-16735# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
COSMIC RAY NM-64 NEUTRON MONITOR DATA, 18 Monthly Graphs, Jan. - Apr. 1971
J. F. Steljes Jun. 1971 77 p
(AECL-3971) Avail: AEC Depository Libraries

Uncorrected and barometer-corrected results from the cosmic-ray stations in Canada using equipment maintained by AECL are given in tabular form for the period from January to April 1971. Normalized graphs are given for the same period. Correction factors for the constant rates of drift of the barometers at each of the four stations are given. A small flare increase occurred on January 24, 1971.
Author (NSA)

N72-16736# Los Alamos Scientific Lab., N.Mex.
AVERAGE THERMAL CHARACTERISTICS OF SOLAR WIND ELECTRONS
Michael D. Montgomery 1971 14 p refs Presented at Solar Wind Conf., Pacific Grove, Calif., 22 Mar. 1971
(LA-DC-12515; Conf-710328-1) Avail: NTIS

Some average solar-wind electron properties based on an extended and significant Vela 4 data sample are presented. The sample used covered the period from May 1967 to May 1968. The thermal properties of the electron component of the plasma are primarily considered. In particular, the electron-to-ion temperature ratio, the electron thermal anisotropy, the total pressure anisotropy, and thermal conduction properties are discussed.
NSA

N72-16737# Los Alamos Scientific Lab., N.Mex.
SOLAR WIND PARAMETER VARIATION, MAGNETIC ACTIVITY, AND ELECTRONS OF THE TAIL OF THE MAGNETOSPHERE AND THE RADIATION ZONE
K. G. Ivanov and N. V. Mikerina Aug. 1971 15 p refs Transl. into ENGLISH of preprint from Akad. Nauk SSSR, Moscow, Inst. Zemnogo Magnetizma, Ionosfery i Rasprostraneniya Radiovoln
(LA-TR-69; Preprint-2) Avail: NTIS

Data from previous works are used to analyze the solar wind parameter variation and magnetic activity. A high correlation is expected from the magnetic activity variations with the variations of the southern component of the magnetic field or the eastern component of the electric field of the solar wind. The variations of the magnetic activity are fairly closely related to the electron variations in the magnetotail, and it is assumed that a relation exists between the solar wind parameters and the characteristics of the electron fluxes of the magnetosphere.
Author (NSA)

N72-16738# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PLASMA PHENOMENA IN ASTROPHYSICS
Carl-Gunne Faelthammar Sep. 1971 38 p refs Presented at the 10th Intern. Conf. on Phenomena in Ionized Gases, Oxford,

13-18 Sep. 1971
(TRITA-EPP-71-23) Avail: NTIS

In an attempt to describe plasma phenomena, the distribution of plasma in space and its classification are first discussed. Ionospheric plasma processes are considered including ionospheric disturbances such as whistlers. Auroras and magnetic storms are covered as well as the diffusion and acceleration of trapped particles. Plasma interactions with the magnetosphere are touched upon and the solar wind discussed in detail. ESRO

N72-16739# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
STUDY OF SOLAR FLARES BY THE SATELLITES EXPLORERS 33 AND 35 M.S. Thesis
Emmanuel T. Sarris Aug. 1971 194 p refs
(Contract N00014-68-A-0196-0003)
(AD-731686; U-of-Iowa-71-36) Avail: NTIS CSCL 03/2

Solar flares associated with at least one of the following three components of particle emissions - high energy protons E sub p = 50 MeV, low energy protons 0.3 - E sub p - 10 MeV, and electrons E sub e = 50 keV - as detected by the satellites Explorer 33 and Explorer 35 are studied by their X-ray, radio wave, and optical emissions. Author (GRA)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-16740# Specola Vaticana (Vatican City).
ASTRONOMICAL RESEARCHES CARRIED OUT WITH THE ZEISS INSTRUMENTS OF THE VATICAN OBSERVATORY
D. J. K. O'Connell 1971 9 p refs
(Rept-51) Avail: NTIS

Summaries are given of the astronomical research carried out using Zeiss instruments. The instruments include the 40 cm visual reflector, the 40 cm photographic refractor, the 60 cm Cassegrain reflector, and the 4 deg and 8 deg objective prisms (aperture 612 mm). E.H.W.

N72-16741*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FACTORS AFFECTING FREQUENCY AND ORBIT UTILIZATION BY HIGH POWER TRANSMISSION SATELLITE SYSTEMS
Perry W. Kuhns, Edward F. Miller, and Thomas A. Malley [1972] 12 p refs Proposed for presentation at the 23rd Avionics Panel Tech. Meeting on Aerospace Telecommun. Systems, London, 15-19 May 1972; sponsored by Advisory Group for Aerospace Res. and Develop.
(NASA-TM-X-67994; E-6742) Avail: NTIS CSCL 22C

The factors affecting the sharing of the geostationary orbit by high power (primarily television) satellite systems having the same or adjacent coverage areas and by satellites occupying the same orbit segment are examined and examples using the results of computer computations are given. The factors considered include: required protection ratio, receiver antenna patterns, relative transmitter power, transmitter antenna patterns, satellite grouping, and coverage pattern overlap. The results presented indicated the limits of system characteristics and orbit deployment which can result from mixing systems. Author

N72-16742# Geological Survey, Washington, D.C.
MARTIAN SURFACE X-RAY ANALYZER: RESULTS OF TESTS ON UNKNOWNS
B. C. Clark and A. K. Baird Feb. 1972 26 p refs
Avail: NTIS CSCL 03B

An ultraminiature X-ray fluorescence spectrometer designed for possible flight on a Viking spacecraft mission to Mars was used to analyze four unknown rock specimens. Eleven elements were detected in each unknown: Mg, Al, Si, K, Ca, Ti, Fe, Rb, Sr, Zr, and the O-group. In addition to establishing the concentration of each of these elements, upper limits were found for the majority of elements in the periodic table, including P, S, Cl, Ni, Zn, and Pb. Upper limits were also derived for CO2. The results are quite adequate for determining (1) enrichment and depletion factors relative to presumed primordial abundances, (2) normative mineralogy and the rock density that can be inferred therefrom, and (3) rock type (assuming magmatic origin) and degree of differentiation. The radioactive element K was assayed accurately even at low concentrations and the important geochemical ratio, K/Ca, was quantitatively determined for each unknown. All data were taken with the X-ray spectrometer in flight-configured form and using miniature, heat-sterilizable radiation sources and detectors. Author

N72-16743*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 PROJECT. VOLUME 2: PRELIMINARY SCIENCE RESULTS
1 Feb. 1972 73 p refs
(Contract NAS7-100)
(NASA-CR-125548; JPL-TR-32-1550-Vol-2) Avail: NTIS CSCL 22C

Data from six Mariner Mars experiments are presented. Television reconnaissance of Mars and its satellites yielded information on atmospheric phenomena, surface features of the South Polar region, geology, and satellite astronomy. Other experiments involved infrared spectroscopy and radiometry; ultraviolet spectrometry; S band occultation for observing the atmosphere, ionosphere, and topography of Mars; and the use of celestial mechanics, to determine the gravity field pole direction of the planet. K.P.D.

N72-16744*# Translation Consultants, Ltd., Arlington, Va.
STUDY OF THE HIGH TEMPERATURE OXIDATION OF THE SIKHOTE-ALIN IRON METEORITE
Yu. D. Kozmanov, L. A. Filatova, and L. Ye. Lokshina Washington NASA Feb. 1972 9 p refs Transl. into ENGLISH from Meteoritika (Moscow), no. 28, 1968 p 60-65
(Contract NASw-2038)
(NASA-TT-F-14134) Avail: NTIS CSCL 03B

The high-temperature oxidation study of the Sikhote-Alin iron meteorite material and an iron-nickel alloy in air at atmospheric pressure and in an environment with a low partial oxygen pressure is described. Author

N72-16745# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 215
25 Jan. 1972 23 p Transl. into ENGLISH from Eastern European reports
(JPRS-55020) Avail: NTIS

Research programs on radiation protection for long space flights are briefly reviewed, proposed atomic physics studies are outlined, and recently appointed scientists are mentioned. The radiation protection investigations include the following: lethal and mutagenic effects of chronic low-intensity doses of radiation on microorganisms; ionizing radiation effects on interferon formation in mice; chronic ionizing radiation effects on antibody production in dogs; development of depth doses in small, medium, and large animals and in man; development of phantoms; and biopositive effects of small doses of ionizing radiation on biological systems. N.E.N.

N72-16746# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY,

AND SPACE, NO. 269
31 Jan. 1972 82 p refs Transl. into ENGLISH from Russian reports
(JPRS-55059; CSO-1866-W; Rept-5303) Avail: NTIS

Materials from recent publications of the Sino-Soviet bloc countries are presented in the form of abstracts, summaries, and occasionally, full articles. The topics covered are astronomy, meteorology, oceanography, geology, upper atmosphere, and space research. Author

N72-16747*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME IMPLICATIONS OF SATELLITE SPIN EFFECTS IN CYLINDRICAL PROBE MEASUREMENTS
Nathan J. Miller Nov. 1971 34 p refs Submitted for publication
(NASA-TM-X-65803; X-621-71-446) Avail: NTIS CSCL 22C

In-situ measurements of ambient electron densities with satellite-borne cylindrical probes exhibit periodic variations synchronous with the satellite's spin cycle. Representing these fluctuations as a superposition of effects attributable to both the presence of the satellite wake and the geomagnetic field leads to a model of the modulations of accelerated electron current to cylindrical probes in which one modulation component displays current variations dependent upon the probe-velocity angle (psi) and the other displays variations dependent upon the angle between the probe axis and the geomagnetic field lines (beta). The modulations produce an electron current decrease whenever the probe axis rotates into the satellite wake or whenever the probe axis rotates toward alignment with the geomagnetic field lines. With increasing altitude, the modulation dependent upon psi decreases whereas the modulation dependent upon beta increases. The analysis results imply that the most accurate of atmospheric electron densities by satellite-borne cylindrical probes come from measurements taken out of the satellite's wake and when the probe axis is within 20 degrees of being perpendicular to the geomagnetic field lines. Author

N72-16748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COOLING OF PULSARS
Sachiko Tsuruta, V. Canuto, J. Lodenquai (Columbia Univ., N. Y.), and M. Ruderman (Columbia Univ., N. Y.) Dec. 1971 16 p refs Submitted for publication Sponsored in part by NSF
(NASA-TM-X-65809; X-640-71-515) Avail: NTIS CSCL 03B

Cooling rates are calculated for superfluid neutron stars of about one solar mass and 10 km radius, with magnetic fields from zero to about 10 to the 14th power Gauss, when possible internal friction effects are neglected. The results show that most old pulsars are so cold that thermal ionization of surface atoms would be negligible. At an age of a million years and with canonical magnetic fields of 10 to the 12th power Gauss, the estimated stellar surface temperature is several thousand to a hundred thousand degrees. However, if we neglect magnetic fields and superfluid states of nucleons, the same surfaces would be about a million degrees. Author

N72-16749# Royal Greenwich Observatory, Herstmonceux (England).
THE PROPER MOTIONS OF RR LYRAE VARIABLES, PART 2
S. V. M. Clube, Z. Aslan, T. W. Russo, and E. D. Clements 1971 38 p refs Prepared jointly with Roy. Obs., Cape Town
(Bull-161) Avail: NTIS; Roy. Greenwich Obs.: £0.55

The proper motions of RR Lyraes presented results from a continuation of a program already outlined and developed. Most of the present second-epoch material involved has been secured with the Cape 13-inch astrographic telescope, while most of the measuring has been carried out on a Zeiss two-coordinate measuring machine at Herstmonceux. The first-epoch positions have been taken from the Astrographic Catalogue throughout, save in a few cases where plate material has been made available. A Fortran program which performs the reduction routines described in a previous paper has been prepared and these latest reductions have been carried out entirely on the Herstmonceux ICL 1909. A description of the reduction is presented, followed by a presentation of the proper motions. These results are then discussed very briefly. Author (ESRO)

N72-16750# Royal Greenwich Observatory, Herstmonceux (England).
RESULTS OBTAINED WITH A DANJON ASTROLABE AT HERSTMONCEUX. PART 2: ANALYSIS AND DISCUSSION OF HERSTMONCEUX ASTROLABE CATALOGUE
D. V. Thomas and R. E. Wallis 1971 60 p refs Prepared jointly with Roy. Obs., Cape Town
(Bull-160) Avail: NTIS; Roy. Greenwich Obs.: £0.85

An analysis and assessment of the Herstmonceux astrolabe observations are presented. Comparison of the time and latitude results with the results obtained with neighboring PZT shows satisfactory agreement when differences in the adopted systems of star places and personal equations of the astrolabe observers are taken into account. Unexpectedly large personal equations in time and latitude appear to have resulted from inaccurate orientation of the instrument. Large variations in effective prism angle have been found to result from changes in ambient temperature. The effects on the results have been greatly reduced, however, by the application of empirical corrections. Some proposals are made for improving the precision and scope of the astrolabe. Author (ESRO)

N72-16751# Mons Univ. (Belgium). Faculty of Sciences.
COUNTING PHASE DETERMINATION FROM THE PHOTOMETERIC CHANNEL Ultraviolet spectrophotometric survey of the sky
E. Blondelot [1972] 11 p
(Commun-21) Avail: NTIS

The histogram of photometric readings from a single star essentially depends on the star image quality and the counting phase. The latter quantity appears because of the finite length of counting intervals and may be measured by the position of the image center at the beginning of the first nonzero counting interval. The knowledge of the phase of a stellar signal allows a better definition of the wavelength scale in the spectrophotometric channels as well as a refined altitude determination. A set of criteria for star signal detection is derived on the basis of the counting phase. ESRO

N72-16752# Royal Aircraft Establishment, Farnborough (England).
DETERMINATION OF THE ORBIT OF COSMOS 307 ROCKET AND ITS USE IN ATMOSPHERIC RESEARCH
H. Hiller Jul. 1971 17 p refs
(RAE-TR-71151) Avail: NTIS

About 1200 observations from 46 observing stations were used to determine the orbit of Cosmos 307 rocket (1969-94B) at 25 epochs spread throughout its nine-month orbital life. The determination was made using the RAE computer program for the refinement of orbital parameters, PROP. The values of orbital inclination obtained, which had standard deviations down to 0.4 sec of arc, were adjusted to account for various perturbations and then used to find the mean rotational speed of the Earth's atmosphere, to give lambda = 1.06 + or - 0.04 rev/day at a mean height of 240 km. Values of density scale height of the upper atmosphere were calculated from the change in perigee distance and found to vary from 31 km to 210 km altitude to 53 km at 270 km altitude. The rms scatter in scale height is about 4 km. Author (ESRO)

N72-16753# Army Electronics Labs., Fort Monmouth, N.J.
COMPARISONS OF COORDINATE SYSTEMS AND TRANSFORMATIONS FOR TRAJECTORY SIMULATIONS
Bernard F. Engebos Jul. 1971 33 p refs
(Task-1T061102B53A-17)
(AD-732334; ECOM-5397) Avail: NTIS CSCL 19/4

Four right-hand orthogonal coordinate systems are defined and the transformations between these systems are developed. They are: a local topocentric launcher system, an earth-centered inertial system, a body axis system, and an aeroballistic axis system. The determination of time derivatives of direction cosines is used to transform information between the inertial and body systems. Euler angles are used to transform data between the inertial and aeroballistic axis systems. Strengths and weaknesses of these transforms are then compared. Finally, a comparison of results of trajectory simulations is presented.
Author (GRA)

N72-16754# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MANEUVERING OF SPACE VEHICLES
K. B. Aleksev, G. G. Bebenin, and V. A. Yaroshevskii 27 Aug. 1971 531 p refs Transl. into ENGLISH of the book "Manevrirovaniye Kosmicheskikh Apparotov" Moscow, Izd-vo Mashinostroyeniye, 1970 p 1-416
(AF Proj. 4160-10; DIA-Task-T70-16-1)
(AD-731357; FTD-MT-24-29-71) Avail: NTIS HC $6.00/MF $0.95 CSCL 22/3

The book discusses the theoretical bases and the methods for calculating the maneuver trajectory of a space vehicle when accomplishing orbital rendezvous operations, during flight to and landing on the Moon, during interplanetary flight and during the descent to the Earth. It examines the equations of the movement of a space vehicle, methods of changing the parameters of orbital motion under pulse and continuous thrust, and also the possible principles of construction of systems for controlling the descent trajectory of the space vehicle. The book gives methods for measuring the parameters of trajectories and the method of differential correction for determining the size of the correcting pulses. Author (GRA)

N72-16755# Western Michigan Univ., Kalamazoo. Dept. of Chemistry.
ABSTRACTS OF PAPERS OF THE 12TH AFOSR CONTRACTORS MEETING ON KINETICS OF ENERGY CONVERSION Interim Report
Thomas Houser 9 Sep. 1971 30 p refs Conf. held at Kalamazoo, Mich., 9-10 Sep. 1971
(Grant AF-AFOSR-1291-67; AF Proj. 9750)
(AD-732310; AFOSR-71-2481TR) Avail: NTIS CSCL 07/4

The report is a compilation of abstracts of the research results presented at the 12th AFOSR Contractors Meeting on Kinetics of Energy Conversion held at Western Michigan University in Kalamazoo, Michigan on 9-10 September 1971. The research presented was concerned with the topics of combustion and ignition kinetics, rates of elementary reactions, and the preparation of and the study of the properties of energetic species.
Author (GRA)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-16756*# Martin Marietta Corp., Denver, Colo.
PRELIMINARY DESIGN OF A SHUTTLE DOCKING AND CARGO HANDLING SYSTEM Final Report, Executive Summary
Dec. 1971 54 p
(Contract NAS9-11932)
(NASA-CR-115368; MSC-05218) Avail: NTIS CSCL 22B

Work performed prior to concept selection, concept evaluation, and the preliminary design are summarized. The initial work included selection of the requirements and guidelines used to formulate concepts; analysis to determine detailed requirements for reach, velocity, torque, etc.; formulation of the alternative concepts; the evaluation and ranking of the concepts; and the selection of a concept. The man-in-the-loop simulation performed with a six degree of freedom moving base simulator and a three degree of freedom manipulator arm are described. The analysis and tradeoffs of those design parameters which are the key to the preliminary design are described. Estimates for a future development program are presented, including a schedule and manpower breakdown and cost estimate. The system design parameters, with a weight and power breakdown are summarized. Author

N72-16757*# Martin Marietta Corp., Denver, Colo.
PRELIMINARY DESIGN OF A SHUTTLE DOCKING AND CARGO HANDLING SYSTEM Final Report
Dec. 1971 391 p refs
(Contract NAS9-11932)
(NASA-CR-115369; MSC-05218) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B
For abstract, see N72-16756.

N72-16758*# National Aeronautics and Space Administration, Washington, D.C.
SPACE SHUTTLE: NEWS RELEASE
Feb. 1972 21 p
(NASA-TM-X-67509) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22B

The space shuttle fact sheet is presented. Four important reasons for the program are considered to be: (1) It is the only meaningful new manned space program which can be accomplished on a modest budget. (2) It is needed to make space operations less complex and costly. (3) It is required for scientific applications in civilian and military activities. (4) It will encourage greater international participation in space flight. The space shuttle and orbiter configurations are discussed along with the missions. The scope of the study and the costs of each contract for the major contractor are listed. F.O.S.

N72-16759*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC CHARACTERISTICS OF THE NORTH AMERICAN ROCKWELL SPACE SHUTTLE DELTA-WING ORBITER (110C) ALONE AND WITH BELLY-MOUNTED EXTERNAL OXYGEN/HYDROGEN TANKS (M EQUALS 0.6 TO 5.0)
E. C. Allen Jan. 1972 195 p
(Contract NAS8-4016)
(NASA-CR-120014; NASA-SER-S-0050; DMS-DR-1185; DRL-184-58) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations were conducted at the MSFC 14 x 14 inch trisonic wind tunnel on a .0044 scale model of the space shuttle orbiter, 110C. The test configurations included the orbiter alone and with external oxygen/hydrogen belly tanks. The six component aerodynamic force and moment data obtained cover a Mach number range from 0.6 to 4.96 at angles of attack from 10 to 60 deg at 0 deg sideslip angle and -10 to 10 deg at -6 deg sideslip angle. Reynolds number per unit length varied somewhat with Mach number but was a nominal 6.8 million per foot. Author

N72-16760# Lockheed Missiles and Space Co., Palo Alto, Calif.
FUNDAMENTAL PRINCIPLES OF CONSTRUCTING SCIENTIFIC APPARATUS BLOCKS OF METEOROLOGICAL RESEARCH ROCKETS
A. A. Shidlovskii and V. P. Teslenko [1971] 6 p refs Transl. into ENGLISH from "Fizicheskie Protsessy v Verkhnei Atmosfere Zemli, Trudy 16" Inst. of Exptl. Meteorol. Moscow, Gidrometeoizdat., 1970 p 104-110
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The design principles, operation, and checkout procedures of instrument shelves used in meteorological research rockets are presented. The dependence of construction principles and design on methods of measurement are also discussed. Illustrations are given. E.H.W.

N72-16761# Royal Aircraft Establishment, Farnborough (England).
ORBITAL OPERATIONS HANDBOOK FOR THE X3 SATELLITE
V. W. Adams Aug. 1971 63 p refs
(RAE-TR-71172) Avail: NTIS

Orbital operations and spacecraft systems of the X3 Satellite are described. Separate sections deal with: operations and control, communications, orbital computations support, and data processing. In addition, the experiments that will be conducted onboard the satellite are summarized, and the methodology for implementation is given. ESRO

N72-16762# European Space Research Inst., Frascati (Italy).
REPORT ON PHOTO-SHEATH CALCULATIONS FOR THE SATELLITE GEOS
Mattias Soop 1971 27 p refs Submitted for publication
Avail: NTIS

Results of computations to determine the electric field perturbation around the GEOS satellite, arising from photoemission, are presented. The satellite is assumed to be spherical. Photoelectron emission on the sunlit side of the satellite causes the formation of an asymmetric electron cloud. The satellite is simulated as having an electrically conducting surface, and an insulating surface. The photoelectrons are represented by rings of negative charge around the symmetry axis. Results and limitations of the computerized simulation are discussed, one of the results being a motion picture showing the electric field and electron motions. ESRO

N72-16763# ARO, Inc., Arnold Air Force Station, Tenn.
OAR-901 SATELLITE THERMAL TEST Final Report
N. C. Latture AEDC Oct. 1971 127 p ref
(Contract F40600-72-C-0003; ARO Proj. VR0172)
(AD-731772; ARO-VKF-71-133; AEDC-TR-71-157) Avail: NTIS CSCL 22/2

The OAR-901 satellite flight is part of the continuing upper atmosphere experimental program. The satellite was tested in a vacuum chamber to establish equilibrium temperatures for three different orientations. Tests were successfully completed for two fixed orientations and with the satellite rotating plus or minus 270 deg at 0.5 rpm. Solar simulation cycling was also performed to simulate earth shadowing. Simulated flight performances were accomplished satisfactorily. All facility equipment functioned satisfactorily throughout the test. Author (GRA)

N72-16764# ARO, Inc., Arnold Air Force Station, Tenn.
DYNAMIC STABILITY TESTING OF SPACE SHUTTLE CONFIGURATIONS DURING ABORT SEPARATION AT MACH NUMBERS 1.76 AND 2 Final Report
Bob Uselton and Arthur R. Wallace AEDC Oct. 1971 68 p refs
(Contract F40600-72-C-0003; ARO Proj. VT2128)
(AD-731771; ARO-VKF-TR-71-115; AEDC-TR-71-198) Avail: NTIS CSCL 22/2

Wind tunnel tests were conducted to determine the dynamic- and static-stability derivatives of approximately 0.011-scale North American Rockwell straight wing and delta wing orbiters in proximity with an 0.011-scale General Dynamics/Convair delta wing booster. Interference-free data on the orbiter models were also obtained. Measurements were made with a forced-oscillation dynamic balance as the model oscillated plus or minus 1.6 deg at angles of attack ranging from -6.8 to 9.7 deg. Data were obtained at Mach numbers 1.76 and 2 and at free-stream Reynolds numbers, based on orbiter model length, ranging from 2,030,000 to 6,330,000. Both orbiter configurations were dynamically and statically stable, and in general, the level and trends of the orbiter derivatives were not greatly affected when in the proximity of the booster. The present damping data show fair agreement with damping data from the National Aeronautical Establishment (NAE), which are the only other known damping data of this type. Author (GRA)

N72-16780 Raytheon Co., Bedford, Mass. Missile Systems Div.
HAWK SUSPENSION SYSTEM PERFORMANCE ON M754 TRACKED VEHICLE
Paul V. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 159-169 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16915 Martin Co., Orlando, Fla. Structure Analysis Dept.
RAIL LAUNCHING DYNAMICS OF THE SAM-D SURFACE-TO-AIR MISSILE
Martin Wohltman, Leonard A. VanGulick, and Carlton H. Sutphin *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 219-230 Prepared for Raytheon Co., Lexington, Mass. (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

N72-16430*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SPACECRAFT ELECTRICAL FIRE SAFETY
Anthony W. Wardell *In its* Conf. on Mater. for Improved Fire Safety 1971 p 173-178 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 22B

N72-16436*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY CONTROL IN THE OXYGEN ENVIRONMENT OF THE APOLLO GUIDANCE AND NAVIGATION EQUIPMENT
Max D. Holley and Stanley Bachman *In its* Conf. on Mater. for Improved Fire Safety 1971 p 211-217 ref This rept. was not presented at the conf. (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 22B

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-16765 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, NO. 41. PART 2: KEYNOTE, PHYSIOLOGICAL EFFECTS, ISOLATION AND DAMPING
Dec. 1970 174 p refs Presented at 41st Symp. on Shock and Vibration, Air Force Academy, Colo., 27-29 Oct. 1970 7 Vol.
(AD-723347; Bull-41-Pt-2) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20/11

Impact and vibration effects on human beings were investigated. Shock isolation systems and their elastic properties were considered, as well as various systems for noise and

vibration reduction. For individual titles, see N72-16766 through N72-16780.

N72-16766 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE DYNAMIC CENTURY
D. Zonars *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 1-3 (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An analysis of problems encountered in aerospace engineering is presented. Noise pollution and its relation to structural failure, flight in the transonic range of speeds, and aircraft design are considered. K.P.D.

N72-16767 Naval Ship Research and Development Center, Washington, D.C.
TESTING AND MODELING STANDING, MAN'S RESPONSE TO IMPACT c04
Joseph Gesswein and Paul Corrao *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 5-12 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Volunteers were dropped from heights of two to nine inches to land, stiff-legged on a rigid force gage. A linear relationship was found to exist between the logarithms of the peak force developed and the kinetic energy at impact. A mathematical model was then developed to reproduce this relationship and to adhere to the general shape of the subject's force-time response. Author

N72-16768 Birmingham Univ. (England). Dept. of Mechanical Engineering.
EQUAL ANNOYANCE CONTOURS FOR THE EFFECT OF SINUSOIDAL VIBRATION ON MAN c04
C. Ashley *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 13-20 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A method for solving problems of subjective response to vibration is suggested. A random vibration spectrum was used as a datum, and a cross-matching procedure with sinusoidal vibration was employed to find constant annoyance contours. This method was applied experimentally to the standing position and shows a minimum sensitivity of 1.7 Hz with increased sensitivity towards 0.7 Hz. Maximum sensitivity occurred between 6 and 15 Hz. The standard deviations of the results were small compared to previous investigations. The contours agreed with the proposed International Standards Organization recommendation on vibration sensitivity of man. Author

N72-16769 Pennsylvania State Univ., University Park. Ordnance Research Lab.
ISOLATION FROM MECHANICAL SHOCK WITH A MOUNTING SYSTEM HAVING NONLINEAR DUAL PHASE DAMPING
J. C. Snowdon *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 21-45 refs Sponsored by NRL (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

It is shown that, when the foundation of a simple mounting system is transiently displaced, the use of a shock mount having nonlinear dual phase damping can simultaneously minimize the resulting acceleration and displacement of the mounted item. The dashpot of the nonlinear system considered here exerts a dual phase damping force that is small when the system undergoes abrupt transients, but is significantly larger during the slow decay of motion that follows this abrupt loading, and when the system is subjected to less abrupt transients. The response of the mounted item was calculated from closed form expressions derived for the linear mounting system considered, or obtained by numerical integration of a differential equation of motion incorporating the dual phase damping characteristic of the mounting system. Author

N72-16770 Virginia Univ., Charlottesville.
INTERACTIVE OPTIMAL DESIGN OF SHOCK ISOLATION SYSTEMS
W. D. Pilkey *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 47-51 ref (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A computational scheme is described whereby an optimal shock isolation system can be interactively designed. Primary design criteria and constraints are assumed to be physical variables, e.g. rattle space requirements and peak acceleration of a fragile package, while other factors, such as cost, are acceptable as secondary criteria. No restrictions regarding linearity or passivity are placed on the isolator. Characteristics of the theoretically optimal design were automatically generated and are displayed for a prescribed shock environment. Isolation elements and parameters were selected which led to a system that behaves similarly to the theoretical optimum. The computer program, which can be implemented on remote desk-top terminals, permits the user to study the sensitivity of his design to changes in design parameters and shock environment. Author

N72-16771 IIT Research Inst., Chicago, Ill.
DESIGN OF HIGH PERFORMANCE SHOCK ISOLATION SYSTEMS
Ronald L. Eshelman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 53-75 refs (See N72-16765 07-32)
(Contract F04694-67-C-0076)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Design procedures are described which were developed and used to evaluate classes of mechanical shock isolators with respect to their function in a specified shock environment. The specification of shock environments is discussed in general terms, and the environment is specified by a pulse. Isolation systems performance criteria are prescribed in terms of equipment fragility levels and rattle space. Isolator concepts with long stroke capability useful in shock applications are described. It is shown that single-degree-of-freedom models cannot adequately simulate isolator behavior. The isolator must be modeled as a multidegree-of-freedom system with distributed mass, damping, and elasticity. Author

N72-16772 Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
ELASTIC WAVE PROPAGATION IN A HELICAL COIL WITH VARYING CURVATURE AND ITS APPLICATION AS AN IMPACT LOAD DISPERSER
Nam P. Suh *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 77-88 refs (See N72-16765 07-32)
Avail: Director Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Elastic stress pulse propagation in a helical coil with varying radius of curvature was experimentally investigated by loading the coil tangentially as a means of effectively dispersing impact loads to lower their amplitude. It is shown that the stress pulse

decomposes into many components, with the high frequency ones propagating faster than low frequency. The pulse disperses faster when the helical coil is loaded at the smaller end than when loaded at the larger end. The coil with the smallest radius of curvature acts as an acoustic filter, in that the amplitudes of the waves passing through this coil do not change. The experimental results are discussed qualitatively in terms of a theoretical analysis of dispersion characteristics. The radius of the cross section influences the phase and group velocities in the range considered. Author

N72-16773 Sandia Labs., Livermore, Calif.
ANALYSIS OF THE INVERTING TUBE ENERGY ABSORBER
J. M. Alcone *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 89-94 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An approximate analysis is developed for plastic deformation encountered when a thin-walled cylinder is inverted. Interest in this type of device arises from the need for energy absorption in protecting critical components (or people) during crash conditions. Mechanisms utilizing this process are characterized by high specific energy absorption and a rectangular force-displacement relation. Generalized design curves for predicting the inversion geometry and force characteristics are developed. The analytical results compare well with experimental data from two independent sources. Author

N72-16774*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE EFFECTS OF PAYLOAD PENETRATION AND VARIOUS ANALYTICAL MODELS ON THE DESIGN OF A SPHERICAL CRUSHABLE CASING FOR LANDING ENERGY ABSORPTION
Robert W. Warner and Margaret Covert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 95-104 refs (See N72-16765 07-32)
(NASA-TM-X-67493) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

The important consequences of penetration by a spherical payload into its crushable casing during landing impact are verified for five models. Three groups of design examples are presented for an impact velocity of 300 feet per second with a choice of zero or perfect bonding between the payload and the casing. In two of the three groups, the use of bonding to prevent payload penetration was found to increase the weight of the crushable casing. Author

N72-16775 Air Force Materials Lab., Wright-Patterson AFB, Ohio. Metals and Ceramics Div.
EFFECT OF FREE LAYER DAMPING ON RESPONSE OF STIFFENED PLATE STRUCTURES
David I. G. Jones *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 105-120 refs (See N72-16765 07-32)
(Task-735106)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390: $15.00/set

Simple formulae are derived using the normal mode method, representing the effect of uniform free layer treatments on modal damping, stiffness, and stress levels under uniform random loading of stiffened skin-stringer type structures. The damping and stiffness formulae are simple generalizations of the Oberst equations of a uniformly covered unstiffened structure and are subject to similar limitations and restrictions. The formulae for random rms stress levels account for multimodal response and give the maximum nominal stress in the skin regardless of where this maximum occurs. Author

N72-16776 Dayton Univ. Research Inst., Ohio.
VIBRATION CONTROL BY A MULTIPLE LAYERED DAMPING TREATMENT
A. D. Nashif and T. Nicholas (AFML) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 121-131 refs (See N72-16765 07-32)
(Contract F33615-70-C-1337; Task-735106)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Multiple, constrained layer damping treatment is represented in terms of equivalent free layer damping. The analysis is accomplished by considering treatment of an anisotropic beam with different stiffnesses and damping in shear and extension. Optimization for this treatment is shown to be a function of wave length, temperature, and geometry for a given damping material. Experimental results are presented to verify the analysis. Author

N72-16777 International Business Machines Corp., Rochester, Minn. General Systems Div.
DETERMINATION OF DAMPING PROPERTIES OF SOFT VISCOELASTIC MATERIALS
Fakhruddin Abdulhadi *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 133-139 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2 Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The frequency and composite loss factor equations for a beam with a constrained damping layer are uncoupled to yield equations for the loss factor and the shear storage modulus of the constrained viscoelastic layer. Each of the loss factor and storage modulus equations is expressed in terms of the resonant frequency, the composite loss factor, the mode number, and the geometry of the cross section of the beam. Error analysis was performed using these two equations to determine the magnification of the relative errors in the calculated material loss factor and the storage modulus due to errors in the measured resonant frequency and composite loss factor. Author

N72-16778 Lord Mfg. Co., Erie, Pa.
IMPROVING RELIABILITY AND ELIMINATING MAINTENANCE WITH ELASTOMERIC DAMPERS FOR ROTOR SYSTEMS c02
J. L. Potter *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 141-149 refs (See N72-16765 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Elastomeric dampers are described which are designed to prevent helicopter and/or VTOL rotor system instability. The damper employs a highly damped viscoelastic polymer, vulcanized and bonded to metallic members. Deformation of the viscoelastic material produces a total resisting force composed of a damping and an elastic component operating 90 degrees out of phase due to the hysteresis inherent in the polymer. Damper service life can be in the range of 1500 to 2000 flight hours with no maintenance or lubrication required. Lubrication and elimination of maintenance are accomplished through use of the viscoelastic material, design simplicity, and no sliding surfaces. Operation is possible throughout a temperature range of -65 to +200 F.
Author

N72-16779 California State Coll., Fullerton.
EFFECT OF HIGH POLYMER ADDITIVES ON DIFFUSER FLOW NOISE c12
B. M. Ishino and R. C. Binder (Univ. of Southern Calif., Los Angeles) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 151-157 refs (See N72-16765 07-32)
(Contract N60530-1136)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An exploratory investigation was conducted to determine the effects of dilute concentrations of high molecular weight polymers in water on liquid flow noise. Experimental measurements were made in a two-dimensional variable angle diffuser with water and aqueous solutions of the polymers polyethylene oxide and guar gum, for different flow conditions. In the region of marginal separation, reductions in overall sound pressure level up to 10 decibels were obtained. The investigation required the design and development of a bench-type blow down water tunnel system and the instrumentation necessary for acquiring flow data. Test results show noise and energy level comparisons between polymer solutions and water for various flow rates and diffuser wall angles. Author

N72-16780 Raytheon Co., Bedford, Mass. Missile Systems Div.

HAWK SUSPENSION SYSTEM PERFORMANCE ON M754 TRACKED VEHICLE c31

Paul V. Roberts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, pt. 2 Dec. 1970 p 159-169 refs (See N72-16765 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A rubber isolator, hydraulic damper, missile launcher suspension is described which protects HAWK missiles from severe tracked vehicle vibration and shock over rough terrain. The isolators are canted 25 degrees in the pitch-vertical plane to decouple vertical, longitudinal pitch modes and to reduce longitudinal and pitch motion. The suspension system was particularly effective in attenuating a broad band of severe tracked vehicle vibration to within + or - 1 g on the missiles. Short period shocks of 5 to 10 msec duration on the vehicle front sprocket and rear idler were attenuated from peaks up to 30 g on the vehicle to 7 g on the missiles. Equivalent static combined load criteria of 7.5 g down, 1.5 g up + or - 4.5 g fore and aft, and + or - 3 g transverse, were substantiated by statistical studies of shock data. Author

N72-16781 Shock and Vibration Information Center (Defense), Washington, D.C.

THE SHOCK AND VIBRATION BULLETIN, DECEMBER 1970. PART 3: INSTRUMENTATION, DATA ANALYSIS, TEST FACILITIES

Dec. 1970 229 p refs Presented at 41st Symp. on Shock and Vibration, Colorado Springs, 27-29 Oct. 1970; sponsored by AF (AD-723348; Bull-41-Pt-3) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set CSCL 20/11

Instrumentation, data processing, and facilities and equipment for shock mechanics and vibration testing of aerospace systems and ground transport vehicles are discussed. Designs of various impact environment simulators are outlined. For individual titles, see N72-16782 through N72-16801.

N72-16782 Endevco Corp., Pasadena, Calif. Dynamic Instrument Div.

A PRACTICAL APPLICATION OF ACCELEROMETER CALIBRATIONS c14

R. R. Bouche *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 1-9 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

High frequency shakers which are virtually free of distortion and transverse motion are used to perform calibrations depicting the true performance of accelerometers. A recently published standard is most useful as a guideline in performing calibrations. The sensitivity calibration is performed at 100 Hz on accelerometers intended for ordinary use in shock and vibration measurements. Author

N72-16783 Agricultural Research Service, Davis, Calif. Transportation and Facilities Research Div.

DESIGNING AN INSTRUMENTED TEST EGG FOR DETECTING IMPACT BREAKAGE c14

William L. Shupe and Robert M. Lake *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 11-16 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

An electronic shock sensing device for detecting areas of egg breakage occurring in commercial grading and packing equipment was designed, constructed, and laboratory tested. A small accelerometer and transmitter system was built into a plastic egg-shaped container. The signal generated by the accelerometer caused by any sudden impact encountered was recorded on the screen of an oscilloscope. The image was a sharp spike that was readily measured, as to severity, on the screen's grid. Author

N72-16784 Army Tank-Automotive Command, Warren, Mich.

AN ACCLEROMETER DESIGN USING FERROFLUID ULTRASONIC INTERFEROMETRY c14

Jack G. Parks *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1971 p 17-24 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

An accelerometer design is described which incorporates the principles of ultrasonic interferometry and ferrofluid dynamics. The chamber of a two transducer ultrasonic interferometer contains two immiscible liquids; one of the liquids being a fluid which responds to a magnetic field gradient. The interferometer is operated at a constant frequency which is slightly different than the resonant frequency caused by reflections from the liquid-liquid interface. Motion of the chamber disturbs the interface and the consequent variation in acoustical path length provides an output signal variation. Damping is accomplished using a magnetic field to modify the motion of the ferrofluid. System variations due to liquid selection, magnetic field intensities, and operating parameters are discussed. Author

N72-16785 TRW Systems Group, Redondo Beach, Calif.

HYBRID TECHNIQUES FOR MODAL SURVEY CONTROL AND DATA APPRAISAL

Robert A. Salyer *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1971 p 25-42 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

The subject is introduced by briefly reviewing the objectives of a Modal Survey and examining the problems generally encountered during the preparation for and performance of a modal survey. A logical growth path to eliminate these problems has culminated in a Computer-Oriented Modal Control and Appraisal System (COMCAS) which utilizes both analog and digital techniques for reduction of modal response data. Author

N72-16786 Lockheed Missiles and Space Co., Sunnyvale, Calif.

OBJECTIVE CRITERIA FOR COMPARISON OF RANDOM VIBRATION ENVIRONMENTS

F. F. Kazmierczak *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 43-54 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard,

Washington, D.C. 20390; $15.00/Set

Analysis of random vibration requires an objective means of accounting for time and amplitude. Use of the peak exceedence curve, the expected number of cycles to exceed some peak amplitude, provides a technique for including both parameters in measuring the damage potential of environments. The procedure is based on the Rayleigh distribution of peak amplitudes in narrow bands and provides a simple method for comparing random vibration environments. An extension of this technique, utilizing Miner's rule, provides a procedure for more accurately measuring the potential fatigue damage. Two detailed examples of how this general methodology is applied are presented.

Author

N72-16787 McDonnell Aircraft Corp., St. Louis, Mo.
THE APPLICATION OF ANALOG TECHNIQUES TO REAL TIME ANALYSIS AND SCREENING OF DYNAMIC DATA **c08**

Roger C. Crites *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 55-61 (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

The necessity of handling large amounts of dynamic data in order to compute complex time variant parameters led to the conception of highly specialized analog computer techniques which enable data analyses and sorting at a small fraction of the time and cost required by a digital computer. These techniques were developed to facilitate ground test assessment of engine-inlet compatibility. The need for, development and successful use of these techniques are described, and potential application to such studies as cumulative fatigue damage and buffet are discussed.

Author

N72-16788 TRW Systems Group, Redondo Beach, Calif
SHOCK LOADING AND HOLOGRAPHIC INTERFEROMETRY IN NDT **c16**

R. L. Johnson, R. Aprahamian, and P. G. Bhuta *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 63-74 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

A brief summary of the principles of holography and holographic interferometry using both the continuous and pulsed laser is given. Photographs of the holographic interferograms obtained of waves propagating in beams and plates are included. The surface displacement of bodies was obtained from the hologram at specific times and is compared with calculated results. The calculated and experimental results show excellent agreement. Finally, and application of pulsed laser holographic interferometry to nondestructive testing, a subject of great current interest, is included.

Author

N72-16789 Spectral Dynamics Corp. of San Diego, Calif.
A NEW SYNTHESIS TECHNIQUE FOR SHOCK SPECTRUM ANALYSIS

William G. Pollard *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 75-80 (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

A new shock spectrum analyzer approach is presented which synthesizes 120 filters to provide primary, residual and maximal shock spectra. The new technique uses only one single-degree-of-freedom filter. The 120 filter locations are generated by sequentially modifying the input excitation time function 120 times.

Author

N72-16790 Arizona State Univ., Tempe.
THE ROLE OF LATENT INFORMATION IN INFORMATION PROCESSING IN MEASURING SYSTEMS **c08**

Peter K. Stein *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 31-107 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

The role of latent information in transducers is defined and discussed. All material properties, all coefficients of scalar, vector, tensor, or field quantities, and all transducer performance coefficients are latent information parameters, (LIPs). A systematic study of these LIPs yields a new conceptual model for a transducer, as an information-and-energy-flow device.

Information processing (including conversion) is clearly distinguished from energy processing (including conversion). The presentation shows hitherto unsuspected affinities between transducer families.

Author

N72-16791 Bureau of Reclamation, Denver, Colo.
USBR VIBRATION TEST SYSTEM **c11**

R. M. McCafferty *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 109-117 refs (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

Described is an electrohydraulic vibration test system. The testing facility, testing equipment, control equipment, instrumentation, and analysis equipment of the system are discussed. Testing and analysis methods used on the present testing program are also covered.

Author

N72-16792 Wyle Labs., Inc., Huntsville, Ala.
MULTI-DEGREE OF FREEDOM MOTION SIMULATOR SYSTEMS FOR TRANSPORTATION ENVIRONMENTS **c11**

T. K. DeClue, R. A. Arone, and C. E. Deckard *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 119-132 (See N72-16781 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

A discussion on multi-degree of freedom motion simulation systems as used to simulate ground transportation and aircraft environment is presented. Described is the approach used to design vibration test environments from which meaningful test results can be obtained. A description of four types of systems, two presently in operation and two under study, is presented.

Author

N72-16793 State Univ. of New York at Buffalo.
DESIGN AND FABRICATION OF AN AIRCRAFT SEAT CRASH SIMULATOR **c11**

Nelson M. Isada *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 133-147 refs (See N72-16781 07-32)

(Grant EC-00287)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

The design and fabrication of a variable slope inclined plane crash simulator is described for the purpose of testing models and prototypes of aircraft seat and passenger-restraint systems, and for validating mathematical models of the dynamics of aircraft seats and restraint systems. The crash simulator consists of: (1) a crash cart; (2) a swiveled inclined ramp with tracks; (3) a decelerating device of sandwich coil springs; (4) a reinforced concrete abutment; and (5) accessory equipments such as quick release and latching mechanisms.

Author

N72-16794 Raytheon Co., Sudbury, Mass.
DESCRIPTION OF A SHOCK AND VIBRATION DISPLACEMENT AMPLIFIER c14
D. Cerasuolo and J. Chin *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 149-154 (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

The technique used to simulate large displacement low frequency dynamic environments found in massive ground based installations is described. The technique utilizes a conventional electrodynamic shaker and readily available commercial test equipment. A prototype of the shock and vibration displacement amplifier was assembled and tested. The performance and theory of operation of this prototype system are discussed. Author

N72-16795 Harry Diamond Labs., Washington, D.C.
ARTILLERY SIMULATOR FOR FUZE EVALUATION c11
H. D. Curchack *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 155-173 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

A unique facility for fuse testing has been constructed that simultaneously provides linear and angular accelerations as they are applied in rifled artillery. The fuse is electrically interrogated during this time and subsequently while the angular velocity is maintained. A description of the device and status of the major components is followed by evidence of the correspondence of test conditions with those of field firings, a discussion of instrumentation, a description of table-top simulators, and discussion of the advantages of the present technique and areas for future development. Author

N72-16796 Sandia Labs., Albuquerque, N.Mex. Heat, Plasma, Climatic, Towers Div.
GAS SPRING FIRING AND THE SOFT RECOVERY OF A HARD-WIRE INSTRUMENTED 155 MM PROJECTILE c14
S. L. Fluent *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 175-186 Sponsored by AEC (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

A technique used in testing hard-wire instrumented 155 mm projectiles is discussed. An 18-inch pneumatic actuator was used as the energy source while a gas spring was used to transmit the energy to the projectile and shape the longitudinal acceleration pulse. The projectile was accelerated through a short section of rifled gun barrel to produce angular acceleration simultaneously with the longitudinal acceleration. The projectile was stopped in a tapered recovery tube which was free to slide on a set of rails. This soft recovery system prevented further damage from occurring to the components inside the projectile after the initial acceleration pulse. A discussion on field testing versus gas spring testing is also presented. Author

N72-16797 IIT Research Inst., Chicago, Ill.
FULL-SCALE RECOIL MECHANISM SIMULATOR (FORCED FLUID FLOW THROUGH A CONCENTRIC ORIFICE) c12
W. J. Courtney, R. Rossmiller (Army Weapons Command), and R. Reade (Army Weapons Command) *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 187-194 (See N72-16781 07-32)
(Contract DAAF01-68-C-0174)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

A full-scale recoil mechanism simulator weighing 14,000 lbs, was designed, fabricated and operated. This simulator was designed as a tool to investigate high pressure high velocity hydraulic fluid flow through a concentric orifice. The nonlinear mathematical model, used as a design aid, is presented. The computer prediction of piston velocities and oil velocities will be compared with the experimental data. Finally, a discussion of the orifice flow together with accumulated data, which includes high speed photography of the oil flow through a viewing part, is presented. Author

N72-16798 Sandia Labs., Albuquerque, N.Mex.
ISOTOPE FUEL IMPACT FACILITY c11
Larry O. Seamons *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 195-205 Sponsored by AEC (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/Set

The use of radioisotope thermoelectric generators as electrical power supplies for space applications has led to a need to characterize the impact sensitivity of the radioactive materials used in these generators. The knowledge is required to more realistically appraise the safety of potential uses. A facility is being developed for safely conducting impact tests of this class of potentially dangerous materials. Author

N72-16799 McDonnell Aircraft Corp., St. Louis, Mo.
A REVERBERATION CHAMBER FOR USE AT REDUCED PRESSURES c11
M. H. Hieken, J. N. Olson, and G. W. Olmsted *In* Shock and Vibration Inform. Center Shock and Vibration Bull., Pt. 3 Dec. 1970 p 207-213 refs (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/Set

A reverberation chamber with an internal volume of 283 cubic feet has been designed, fabricated and evaluated. This chamber has the unique property that it can be used at absolute pressures below 5 psi, in addition to normal operation at ambient pressure. Design and fabrication of the chamber are described. The requirement to operate with low internal pressures resulted in heavy external structural reinforcement. Steel plates form the walls, and provide both rigidity and low acoustic absorption properties. A conventional mechanical vacuum pump is used to evacuate the chamber to the required internal pressures. The results of evaluation tests of the chamber are presented and applications for the chamber are described. Author

N72-16800 Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
DESIGN OF AN OFF-ROAD VEHICLE MOTION SIMULATOR c11
Nelson M. Isada (State Univ. of N.Y., Buffalo), Robert C. Sugarman, and E. Donald Sussman *In* Shock and Vibration Inform. Center Shock and Vibration Bull., pt 3 Dec. 1970 p 215-222 (See N72-16781 07-32)
(Contract DAHC04-67-C-005; ARPA Order 841)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/set

An off-road vehicle motion simulator was designed which is suitable for man-in-the-loop off-road mobility research. One result of this study is the establishment of design specifications for two motion simulator concepts with three degrees of freedom (roll, pitch, and throw). One concept has a short throw and the other a long throw. The feasibility of the short-throw concept was demonstrated by the construction and testing of a working model. Author

N72-16801 Sandia Labs., Albuquerque, N.Mex.
AN AERIAL CABLE TEST FACILITY USING ROCKET POWER c11
C. G. Coalson *In* Shock and Vibration Inform. Center Shock and Vibration Bull., pt. 3 Dec. 1970 p 223-225 Sponsored by

AEC (See N72-16781 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An aerial cable test facility is being used to duplicate many types of air drops. The two basic components of the facility are: an aerial cable stretched between two mountain peaks; and a rocket powered sled track on the valley floor. A test vehicle, attached to a carriage on the aerial cable, is cut loose and accelerated downward via two wire rope towlines which pass through two underground wire rope tunnels and hence to the rocket sled. Impact velocities approaching 1000 ft/sec (with 200 lb test vehicle) can be achieved. The test facility is in a remote area and tests involving large quantities of high explosives can be conducted in complete safety. Author

N72-16802 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN NO. 41. PART 4: VIBRATION
Dec. 1970 221 p refs Presented at 41st Symp. on Shock and Vibration, Air Force Academy, Colo., 27-29 Oct. 1970
(AD-723349; Bull-41-Pt-4) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20/11

The effects of vibration and shock on various structures including aircraft, spacecraft, helicopters, and chain bridges are reported. Detailed summaries are given for the effects of gunfire, grenade launcher and rocket launcher fire, and M61 fire on various structures. For individual titles, see N72-16803 through N72-16823.

N72-16803 Lockheed Missiles and Space Co., Sunnyvale, Calif.
SURVEY OF SPACE VEHICLE VIBRATION ANALYSIS AND TEST TECHNIQUES
W. Henricks, R. J. Herzberg, and B. G. Wrenn *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 1-27 ref (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The survival of space vehicles in a dynamic environment produced by high frequency vibration is discussed. Also discussed are environment prediction, related analysis and test procedures, test philosophy, recent experience, and current results. The technological problems associated with the analysis and testing of space vehicle configurations are assessed. Author

N72-16804 Sandia Labs., Albuquerque, N.Mex. Centrifuge, Vibration, and Acoustics Div.
METHODS USED TO REALISTICALLY SIMULATE VIBRATION ENVIRONMENTS
J. V. Otts *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 29-35 refs Sponsored by AEC (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The test capabilities and test procedures, as well as procedures for deriving input test levels were developed to test vibration effects on various systems. The procedures are based upon field vibration data and weight characteristics of the test unit. Both sinusoidal and random test specifications were considered. E.H.W.

N72-16805 Hughes Aircraft Co., Culver City, Calif.
SIMULATION OF COMPLEX-WAVE PERIODIC VIBRATION
A. J. Curtis, H. T. Abstein, Jr., and N. G. Tinling *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 37-49 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A vibration test method that has general applicability for simulation of complex wave periodic environments is described. The method makes use of a repetitive pulse as an excitation signal for conventional electro-dynamic vibration systems. A description is given of the simple ancillary equipment which, in conjunction with conventional random vibration control equipment, is used to generate and control the desired complex waveform. The use of variable pulse repetition rate and multiple accelerometer signal control is described. In addition, a method for rapid analysis of the line spectrum of the resultant vibration using an existing comb-filter analog/digital vibration analysis system is included. Results of the use of this test method during testing of an airborne weapon control system are described. The economy of test and superior simulation characteristics of the method, compared to alternative approaches such as Method 519 of MIL-STD-810, are discussed. Author

N72-16806 Canadian Forces Headquarters, Ottawa (Ontario).
RATIONALES APPLYING TO VIBRATION FOR MAINTENANCE
A. H. Grundy *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 51-67 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The parameters associated with the measurement of vibration as an indicator of wear in machines and the need for maintenance are discussed. It is concluded that velocity is the most appropriate parameter. Examples are given. Author

N72-16807 Sandia Labs., Albuquerque, N.Mex. Vibration and Acoustics Test Div.
SPECIFICATION OF SINE VIBRATION TEST LEVELS USING A FORCE-ACCELERATION PRODUCT TECHNIQUE
A. F. Witte *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 69-78 refs Sponsored by AEC (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2 Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A technique was proposed for specifying laboratory control vibration test levels. The levels are obtained by using an envelope of the relative minimum values of the test specimen's apparent weight characteristics and the envelope of accumulated peak field acceleration experienced by similar units subjected to similar field environments. A description is included for all the mathematics used to develop the technique, results obtained from a mathematical model, and the laboratory equipment necessary for the use of the technique. Author

N72-16808 Washington Univ., St. Louis, Mo.
SOME EFFECTS OF EQUALIZATION WITH A SINGLE MASS VS AN ELASTIC SYSTEM ON ACCELERATIONS AND STRESSES
R. M. Mains *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 79-85 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C., 20390; $15.00/set

In order to provide some data on the ques[illegible] of where equalization should be done in a random vibration test, an exciter, fixture, test article system was analyzed as a ten-mass system. Two conditions were considered: first with the test article represented as a 5-mass elastic system, and second with the test article represented as a single mass. Comparisons were made of the acceleration responses of the masses in the full system, and of the force responses of the springs in the full system, for various equalization points under the two conditions. The RMS responses to random vibration inputs were also

compared, both RMS acclerations of masses and RMS forces in springs. The differences in both mass motions and spring stresses are as much as a factor of 20 at any specific frequency. The differences in RMS response to random vibration are factors of 5. Results indicate that the desirability of using a dead mass to equaiize a random vibration setup should be reconsidered.
Author

N72-16809 Sandia Labs., Albuquerque, N.Mex. Centrifuge, Vibration, and Acoustics Div.
A METHOD FOR PREDICTING STRUCTURAL RESPONSES FROM LOWER LEVEL ACOUSTIC TESTS
D. O. Smallwood *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., no. 41, Pt. 4 Dec. 1970 p 87-93 refs Sponsored by AEC (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A technique which does not assume system linearity was developed for extrapolating lower level test data to higher sound pressure levels. The technique consists of plotting the RMS structure acceleration response as a function of the input RMS sound pressure level in a frequency band (usually 1/3 octaves). Experimental results have shown that many structures exhibit response characteristics which plot as straight lines on a log-log plot indicating response characteristics of the form g = ap sup n where g is the response, p is the input pressure, and a and n are constants. Frequently n is some number other than one indicating a particular form on nonlinear response. Experimental results from several test programs are presented. A theoretical one degree of freedom system with nonlinear damping is also discussed to illustrate the results. The usefulness of the technique lies in the increased accuracy of the predicted response and an increased understanding of the nonlinearities of the system.
Author

N72-16810 Test Squadron (4750th), Tyndall AFB, Fla.
SWEEP SPEED EFFECTS IN RESONANT SYSTEMS
Ronald V. Trull *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 95-98 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The use of the speed sweep effect to determine the performance characteristics of all systems and system components is discussed. The derived solution assumes a linear increase or decrease in frequency. The solution was checked experimentally and does accurately predict the response of a resonant system to a linearly sweep excitation.
Author

N72-16811 Federal Highway Administration, Washington, D.C.
THE DYNAMIC RESPONSE OF A STEEL EYEBAR CHAIN SUSPENSION BRIDGE OVER THE OHIO RIVER TO VARIOUS APPLIED EXCITATIONS
R. F. Varney and J. G. Viner *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 99-107 ref (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington D. C. 20390; $15.00/set

The dynamic responses of the bridge were induced in two ways. The bridge was first excited by the use of an improvised harmonic vibration generator (located on the riverbank beneath the structure) which exerted a direct vertical cyclic pull on the underside of the midspan point of one of the end spans through a steel wire rope. Resonant vibrations were induced in the structure in the first four normal modes. The measured frequencies and the corresponding mode shapes compared favorably with predicted values. A second type of bridge excitation was provided by the passage of a three axle truck weighing 44,300 pounds crossing the bridge at low speeds. Strain, displacement, and acceleration transducers were installed on the bridge at critical points suggested by local failures noted in the Point Pleasant bridge wreckage. Mean live load stress levels determined at various points throughout the bridge during the vehicle passage were not excessive. Vibrations induced by the vehicle passage were generally of much higher frequency than induced by the vibration generators and represented various modes of individual structural member vibrations
Author

N72-16812 Sandia Labs., Albuquerque, N.Mex. Vibration and Acoustic Test Div.
DUAL SPECIFICATION IN RANDOM VIBRATION TESTING, AN APPLICATION OF MECHANICAL IMPEDANCE
A. F. Witte and R. Rodeman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 109-118 refs Sponsored by AEC (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Modifications to the sinusoidal testing technique are discussed along with possible applications to random vibration testing. The technique utilizes enveloped field data and the impedance characteristics of the test specimen to generate a laboratory random input force spectrum. It also utilizes transfer impedance characteristics to modify the input force spectrum in order to impose response motion limiting in the laboratory situation.
Author

N72-16813 Raytheon Co., Portsmouth, R.I. Submarine Signal Div.
VIBRATION: A DIAGNOSTIC TOOL FOR SHOCK DESIGN
Culver J. Floyd *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 119-126 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington D. C. 20390; $15.00/set

The use of vibration tests to determine possible failure of electronic equipment parts is discussed. The exploratory and qualification test for the parts include (1) non-standard parts qualification, (2) engineering exploratory shock and vibration at the chassis level, (3) cabinet level shock, soft and hard mounts, (4) cabinet level shock vibration, soft and hard mounts, and (5) cabinet level reliability tests per MIL-R-22732, soft and hard. Examinations of stress levels, frequency spectra, material characteristics, and failure indicates that successful completion of a shock test can be accomplished if exploratory vibration tests are run at chassis and cabinet levels without energizing the electronics.
E.H.W.

N72-16814 Comsat Corp., Clarksburg, Md.
THE RESONANT RESPONSE OF A MECHANICAL SYSTEM SUBJECTED TO LOGARITHMICALLY SWEPT AND NOTCHED BASED EXCITATION, USING ASYMPTOTIC EXPANSION
B. N. Agrawal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 127-132 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A method is presented for determining spacecraft structure response, subjected to logarithmically swept and notched base excitation, in sinusoidal vibration testing. The asymptotic method is used to obtain the response of a viscously damped single degree of freedom mechanical system subjected to logarithmically swept and notched base excitation. The unnotched responses and perfect notches are obtained for various notching factors, damping coefficients, sweep rates, and natural frequencies.
Author

N72-16815 Vought Aeronautics, Dallas, Tex.
EFFECTS OF FLIGHT CONDITIONS UPON GUNFIRE INDUCED VIBRATION ENVIRONMENT

J. A. Hutchinson and B. G. Musson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 133-140 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The statistical characteristics of the structural response measured on the A-7 airplane while firing the M61 rapid-fire gun are given. The amplitude versus frequency plots from narrowband analysis and amplitude histogram plots which are presented provide a graphic presentation of the gunfire signal characteristics. A discussion of the relationship between the flight conditions and the measured gunfire vibration levels along with the significance of these relationships in terms of qualification requirements is also presented. Author

N72-16816 C&O/B&O Railroad Companies, Baltimore, Md.
THE BOX CAR DYNAMIC ENVIRONMENT
Robert W. Luebke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 141-160 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The continuous or over-the-road vibration environment within present day railroad merchandise freight car equipment is defined in terms of frequency spectrograms, power spectral density curves, and curves of peak-to-peak accelerations versus speed and load. The effects of suspension system changes being introduced in the industry are also presented. Author

N72-16817 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
THE NOISE ENVIRONMENT OF A DEFLECTED-JET VTOL AIRCRAFT c02
F. L. McFarland and D. L. Smith *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 161-171 ref (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A noise survey conducted on a deflected-jet VTOL aircraft is described. The test aircraft was mounted on a vertical thrust stand with the nozzles oriented in the hover-stop position while engine runs were made at different power settings. Forty one (41) microphones were located in the field on the port side of the aircraft and six (6) microphones were located at positions near the aircraft skin. The height of the field microphones was varied (5 ft, 10 ft, and 15 ft). One-third octave band spectra obtained from all microphones and for all engine power settings were flat and did not exhibit the haystack shape which is characteristic of a free jet. Typical one-third octave band sound pressure level spectra and contours of overall sound pressure levels are presented. Estimates of jet total acoustic power are developed from the measurements and related to engine operating parameters. Expressions are derived from the measurements to predict the one-third octave band spectra at positions in the field and on the vehicle from similarly configured aircraft for various engine operating conditions. Author

N72-16818 General Electric Co., Utica, N.Y. Aerospace Electronic Systems.
VIBRATION SIGNATURE ANALYSIS OF BEARINGS AND ELECTRONIC PACKAGES
Charles H. Roos *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. No. 41, Pt. 4 Dec. 1972 p 173-181 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Vibration signature analysis methods were developed which can be readily and inexpensively applied to assure the quality of rolling bearings and electronic packages. These methods detect a loose item inside a package, a weak bond between a microcircuit substrate and its case, and surface defects on the balls or races of bearings. The results obtained in applying vibration signature analysis to the inspection of product lines are given. Author

N72-16819 Perkin-Elmer Corp., Danbury, Conn.
OUTER LOOP CONTROL FOR VIBRATION TESTING
Gordon Lester and James Gay Helmuth (Chadwick-Hemuth Co., Monrovia, Calif.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 183-187 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The development of multi-shaker control system for use in vibrational testing is discussed. The system, an outer loop, allows preliminary verification of the main loop at low vibration levels, and can be used to increase the total dynamic range of vibration control. The loop also serves to bring all drives up to level together. Results are given in graphical form. E.H.W.

N72-16820 Bendix Corp., Mishawaka, Ind.
EMPIRICAL PREDICTION OF MISSILE FLIGHT RANDOM VIBRATION
A. E. Kartman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 189-194 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The correlation of missile vibration with known or predictable flight data to formulate empirical techniques is discussed. Flight data acquisition, reduction, and characteristics are briefly discussed along with techniques for application of flight data to new hardware requirements. Author

N72-16821 Frankford Arsenal, Philadelphia, Pa.
STRUCTURAL VIBRATIONS IN THE BELL AH-1G HELICOPTER DURING WEAPON FIRING c02
R. J. Holland (Kinetic Systems, Inc., Boston, Mass.), D. Marcus, and J. Wiland *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 195-207 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A test program carried out on the AH-1G Helicopter in which structural response measurements were made during firing of the minigun and the 40mm grenade launcher is described. Measurements were obtained on the gun turret, the aircraft structure near the gunner's station, and on a wing mounted pod. The resulting data is presented both in the form of acceleration time histories and shock spectra. A discussion of the transient response due to the firing of each round is presented as well as the steady state vibration at the weapons' firing rate. Author

N72-16822 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
CHARACTERISTICS OF GUNFIRE INDUCED VIBRATION IN HELICOPTERS c02
C. E. Thomas and V. C. McIntosh *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 209-219 (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Flight measurements of vibration induced by armament fire on three types of helicopters are described. Instrumentation and data analysis procedures are discussed briefly. Overall vibration levels as a function of distance from the gun muzzles are presented. The increase in vibration levels during gunfire over those encountered in normal flight, and the variation in vibration

spectra with rate of gunfire are illustrated. Amplitude probability density curves and oscillograms of acceleration time histories are utilized to indicate the degree of randomness of armament fire vibration in various frequency bands. Author

N72-16823 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
INFLIGHT VIBRATION AND NOISE STUDY OF THREE HELICOPTERS **c02**
Phyllis G. Bolds and John T. Ach *In* Shock and Vibration Inform. Center The Shock and Vibration Bull., No. 41, Pt. 4 Dec. 1970 p 221-232 refs (See N72-16802 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The individual and collective characteristics of these helicopters are determined as a function of dynamic measurement levels. These levels are then related to sources, i.e., rotor aerodynamics, and engine; and performance characteristics, i.e., hover, take off, and speed range. The spatial distribution from vehicle to vehicle are also considered. The measured data used in this study covers jet engine powered helicopters. The data was examined to determine whether it is generally random (distribution of amplitudes) or sinusoidal in nature. The specifications relating to personnel and equipment for vehicles of these general types were examined, and changes were recommended as indicated by these data. Author

N72-16824 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, 41.2 PART 5: SHOCK, FRAGILITY
Dec. 1970 184 p refs Proc. of the 41st Symp. on Shock and Vibration, AF Acad., Colo., 27-29 Oct. 1970
(AD-723350; Bull-41-Pt-5) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20/11

The proceedings of a conference on shock and vibration are presented. Discussions were concerned with the effects of shock on various structures and weapon systems. Methods for evaluating and controlling parameters for structural fragility of shock isolation systems are presented. Pyrotechnic shock criteria and effects in the aerospace industry are examined. The shock load response of an elastic annular plate on a distributed foundation is described. For individual titles, see N72-16825 through N72-16841.

N72-16825*# Martin Marietta Corp., Denver, Colo.
A DISCUSSION OF PYROTECHNIC SHOCK CRITERIA **c33**
M. B. McGrath *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 1-7 refs (See N72-16824 07-32)
(Contract NAS5-15208)
(NASA-CR-125449) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 19A

A set of criteria for predicting pyrotechnic shock environments is presented. The spectra to be expected near the source are presented for a variety of pyrotechnic devices, along with a set of attenuation curves for various types of aerospace structures. Author

N72-16826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SUMMARY OF PYROTECHNIC SHOCK IN THE AEROSPACE INDUSTRY **c33**
W. P. Rader (Martin Marietta Corp., Denver) and William F. Bangs *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 9-15 refs (See N72-16824 07-32)
(NASA-TM-X-67492) Avail: NTIS; Director, Navy Publ. and Printing Service Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 19A

Pyrotechnic shock data obtained from a survey of the aerospace industry and government agencies are presented. Over 2800 measurements from 30 contributors have been compiled and categorized according to type of pyrotechnic device and structure. A reference document to establish guidelines for designing and testing the pyrotechnic shock environment is provided. Author

N72-16827 LTV Research Center Anaheim, Calif. Western Div.
MEASURES OF BLAST WAVE DAMAGE POTENTIAL **c12**
C. T. Morrow *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 17-26 refs (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The shock spectrum is conventionally defined in terms of a physical model but can be considered as a purely mathematical operation on the input excitation. The Fourier spectrum is defined entirely in terms of a mathematical operation to be performed on acceleration, force, pressure, or any variable of interest. It is expressed as a density in that variable, simply related to the generalized residual shock spectrum, but it is a complex number and expresses phase information. The use of the Fourier spectrum as a criterion of severity for sonic booms and blast waves is explored. Author

N72-16828 Ohio Northern Univ., Ada.
SHOCK RESPONSE OF A BILINEAR, HYSTERETIC BEAM AND SUPPORT SYSTEM
Bruce E. Burton and Robert S. Ayre (Colo. Univ., Boulder) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1972 p 27-37 refs (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Shock spectra are presented for an elasto-inelastic beam simply supported at each end on elasto-inelastic supports which are subjected to a half-sine ground acceleration pulse. The beam and supports have, respectively, bilinear, hysteretic moment-curvature, and bilinear, hysteretic force-displacement characteristics. The maximum displacement of the ends of the beam and the maximum bending moment at midspan are presented for six cases in which the beam support system has different elasto-inelastic properties. Author

N72-16829 Naval Civil Engineering Lab., Port Hueneme, Calif.
DIGITAL FOURIER ANALYSIS OF MECHANICAL SHOCK DATA **c19**
H. A. Gaberson and D. Pal *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 39-52 refs (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Fourier transforms of recorded shock motion and their application as classifiable descriptors of mechanical shock hardness are discussed. A self-contained development of the discrete Fourier transform is presented. The finiteness of the transient makes possible an exact representation of the transform at a sequence of discrete frequencies. Interpretation formulas are derived which permit the intermediate values to be computed. Author

N72-16830 Army Weapons Command, Rock Island, Ill.
THE COMPUTER DETERMINATION OF MECHANICAL IMPEDANCE FOR SMALL ARMS FROM THE RESPONSE

TO RECOIL

L. B. Gardner, R. K. Young, and D. E. Frericks *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 53-57 ref (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2 Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A digital technique was developed for determining the mechanical impedance at a weapon-mount interface from data obtained from actual firing on a test mount. Power spectral densities of the force and velocity at the interface were obtained. The use of this information for mount simulation studies is described. Author

N72-16831 Kaman Sciences Corp., Colorado Springs, Colo.
SHOCK PULSE SHAPING USING DROP TEST TECHNIQUES c12

R. E. Keeffe and E. A. Bathke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 59-68 refs (See N72-16824 07-32)
(Contract DAAH01-69-C-1809)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2 Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An analytic technique is described for designing a drop test experiment in which transient acceleration time histories are simulated. Verification of the developed methodology is qualitatively demonstrated by an experimental test program. Author

N72-16832*# International Business Machines Corp., Rochester, Minn.
ANALYSIS OF PROJECTILE IMPACT ON COMPOSITE ARMOR

Richard A. Fine and Raymond R. Hagglund (Worcester Polytech. Inst.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 69-75 refs Sponsored by NASA (See N72-16824 07-32)
Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

Theoretical and experimental analyses were performed to investigate bullet impact effects on ceramic composite armor. The armor consisted of ceramic tile bonded to fiberglass reinforced plastic backing to represent the type of body armor worn by military personnel. Photographic data of the impact event are in good agreement with the theoretical analysis. Photographic data indicated ductile behavior of the bullet during impact. Author

N72-16833 Littleton Research and Engineering Corp., Mass.
A SYSTEMATIC APPROACH TO SHOCK HARDENING c14

J. L. Lipeles and D. Hoffman (Naval Ammunition Depot) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5, Dec. 1970 p 77-88 (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A general specification for the shock hardening of naval ordnance is recommended. Some background to the recommendation is presented along with the salient features of the proposed specification. Author

N72-16834 Honeywell, Inc., Hopkins, Minn.
THE DEVELOPMENT OF SHOCK TEST CRITERIA FOR AIRCRAFT DISPENSER WEAPON EJECTION MECHANISMS

K. D. Denton, K. A. Herzing, and S. N. Schwantes *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 89-99 (See N72-16824 07-32)
(Contract F08635-70-C-001)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A test program and the associated analysis which were conducted to develop both an impact shock test criteria and a shock spectrum simulation test for externally carried aircraft ordnance are described. Typical external sources of excitation such as boundary layer pressure fluctuations or shock excitation from hard or arrested landings are discussed. The effects if self-induced dynamic environments are investigated. Author

N72-16835 Colorado Univ., Denver. Dept. of Civil and Environmental Engineering.
SHOCK LOAD RESPONSE OF AN ELASTIC ANNULAR PLATE ON A DISTRIBUTED FOUNDATION

John R. Mays and James E. Nelson (Martin Marietta Corp., Denver) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 101-109 refs (See N72-16824 07-32)
(Grant NSF GK-4813)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The analysis of the response of an elastic annular plate on a distributed foundation when subjected to a transverse pulse applied at the inner edge was conducted. The pulse shape is a sine function of time having one-half cycle duration. The plate and the foundation have separate force-deformation characteristics. The effects of varying stiffnesses, pulse duration, and the ratio of inner to outer radii are presented. Author

N72-16836 Logicon, Inc., San Pedro, Calif.
METHODOLOGY AND STANDARDIZATION FOR FRAGILITY EVALUATION

R. C. Rountree and F. B. Safford (TRW Systems Group, Redondo Beach) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 111-128 refs (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A general philosophy of fragility methods is presented. The methodology is based on a knowledge of environment at free field, system, or component level. Various interpretations of system and component interactions are examined. Standard tests are described for shock, transient, or vibration testing. Techniques for enhancing decision processes for selecting off-the-shelf products are discussed. Author

N72-16837 Air Force Weapons Lab., Kirtland AFB, N.Mex. Facilities Survivability Branch.
CONTROLLING PARAMETERS FOR THE STRUCTURAL FRAGILITY OF LARGE SHOCK ISOLATION SYSTEMS

Robert J. Port *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 129-134 ref (See N72-16824 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A sensitivity study was performed on the design parameters of a large shock isolated equipment platform supported by six mechanical spring isolators that also function as pendulum arms. The study was performed on a finite difference computer code that calculated the system response for increasing inputs until failure of all six isolators provided an estimate of the system structural fragility. Author

N72-16838 TRW Systems Group, Redondo Beach, Calif.
HARDNESS EVALUATION

W. H. Rowan *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 135-142 (See N72-16824 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A statistical approach to the evaluation of the failure of complex systems is presented. The approach starts with a computation of the free field nuclear effects, the modification of these effects by shock isolation and other protective equipment, and the system response in terms of the probability of component failure due to the weapon induced environments. The component probabilities of failure are combined by means of system failure network logic to obtain the system probability of failure. Author

N72-16839 Boeing Co., Seattle, Wash.
FRAGILITY TESTING FOR HYDRAULIC SURGE EFFECTS c12

D. M. Eckblad and W. L. Hedrick (TRW Systems Group, Redondo Beach) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 143-153 (See N72-16824 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390 $15.00/set

A test to determine the effects of ground motion on the failure of hydraulic equipment is discussed. The effects of a nuclear explosion are simulated to provide the vibrational environment. The components tested, derivation of the test pressure pulse, test procedures and test results are presented. Author

N72-16840 Boeing Co., Seattle, Wash.
INITIAL DESIGN CONSIDERING STATISTICAL FRAGILITY ASSESSMENT

Richard L. Grant *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 155-176 ref (See N72-16824 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The development of shock isolation and equipment for underground nuclear attack resistant weapons systems is discussed. The requirements for statistical assessment either before, during, or after the system is designed and built are examined. It is concluded that the statistical approach to fragility and the impact on the assessment differ from the normal reliability approach to the problem and demand special consideration in the early conceptual and initial design phases. Author

N72-16841 Boeing Co., Seattle, Wash.
TRANSIENT PULSE DEVELOPMENT

Jerry D. Crum and Richard L. Grant *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 167-175 ref (See N72-16824 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The development of a transient vibration pulse to meet shock spectra criteria associated with nuclear explosion effects is discussed. The relative damage potentials of various classes of environments in terms of shock spectra are presented. The rationale for development of the shock spectra criteria for shock isolated equipment is described. Practical application of the transient test pulse technique is included. Author

N72-16842 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN 41. PART 7: MATHEMATICAL ANALYSIS, FLUID-STRUCTURE INTERACTIONS

Dec. 1970 217 p refs Presented at the 41st Symp. on Shock and Vibration, AF Acad., Colo., 27-29 Oct. 1970

(AD-723352; Bull-41-Pt-7) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20/11

Conference papers on shock and vibration studies are presented, emphasizing mathematical analysis and fluid-structure interactions. Vibration effects on various structures are examined, such as Apollo spacecraft, hydrofoils, instrument gages, fuselages, and supports. For individual titles, see N72-16843 through N72-16860.

N72-16843*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ROCKET-SLED MODEL STUDY OF PREDICTION TECHNIQUES FOR FLUCTUATING PRESSURES AND PANEL RESPONSE

Eric E. Ungar, Ron E. Jewell, and Harry J. Bandgren *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 1-7 refs Prepared in cooperation with Bolt, Beranek, and Newman, Inc., Cambridge, Mass. (See N72-16842 07-32)

(NASA-TM-X-67490) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

The rocket-sled-mounted 1/10-scale model of the upper stages of Saturn 5 and the data acquisition system are described. Methods for predicting fluctuating pressures under turbulent boundary layers and subsonic separated flows are summarized and shown to yield predictions which are in reasonable agreement with measurements obtained on the test model. Author

N72-16844 TRW Systems Group, Redondo Beach, Calif.
DETERMINATION OF STRUCTURAL PROPERTIES FROM TEST DATA c08

A. E. Galef and D. L. Cronin *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 9-18 refs (See N72-16842 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A technique for determining the modal characteristics of a multimodal linear structure from the experimentally determined frequency response function was developed and programmed in FORTRAN 4-H. The computer program employs an iterative technique which permits the examination of the portion of the frequency response function that represents the response from each of the separate modes that describe the structure. The frequency, damping, and participation factor of each of these modes is readily determined with accuracy that equals or surpasses the objectives: frequency to within plus or minus 0.1 Hz, damping to within plus or minus 5%, and amplitude to within plus or minus 1 db. Author

N72-16845 Southwest Research Inst., San Antonio, Tex.
VALIDITY OF MATHEMATICAL MODELS OF DYNAMIC RESPONSE OF STRUCTURES TO TRANSIENT LOADS

Wilfred E. Baker *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 19-28 refs (See N72-16842 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Techniques for dynamic analysis of structural transient response are briefly reviewed, with emphasis on predicting permanent deformation or large elastic deformation. Validity of various techniques is assessed, where they can be determined, by comparison. Examples are limited to dynamic response and permanent deformation of beams and cylindrical shells. The following aspects of the problem are treated: (1) replication of predicted response using the same basic mathematical technique but different choice of lumping parameters; (2) repeatability of experimental results; and (3) validity of various techniques of

analysis, expressed as percent deviation from averaged experimental data. Author

N72-16846 Office of Naval Research, Arlington, Va.
DYNAMIC RESPONSE OF PLATES WITH CUT-OUTS
Nicholas L. Basdekas and Michael Chi *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 29-35 refs Prepared in cooperation with Catholic Univ. of Am., Washington, D. C. (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The forced and free dynamic response of plates with cut-outs is formulated. Results obtained for free vibration of a simply supported plate are compared qualitatively with different boundary conditions. Computations were carried out for two sizes of central square cut-outs in a simply-supported square plate. Based on the results, the procedure convergence and the judicious selection of the size of the approximate frequency equation are discussed. Author

N72-16847 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NATURAL FREQUENCIES AND MODE SHAPES OF PLATES WITH INTERIOR CUT-OUTS
J. Monahan, P. J. Nemergut, and G. E. Maddux (AFSC, Wright-Patterson AFB) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 37-49 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The effect of square holes on the natural frequencies and mode shapes of a 7 in. x 10 in. clamped rectangular plate were investigated. The frequencies of the first five modes were obtained in separate experiments using holographic interferometry and accelerometers and analytically using the finite element method. The mode shapes were observed in the holography experiment, and photographs were taken. For a plate without holes, the experimental frequencies were approximately 10% lower than the theoretical values possibly due to some rotation of the plate edges. Using a 25 element model, the finite element program gave the frequencies within 1% of the theoretical values. For central square holes, the frequencies of each mode varied with hole size in a number of ways. For example, the fundamental frequency decreased slightly and then increased and the second frequency decreased as hole size increased. In addition, a correlation between the variation of frequencies and mode shapes was noted. Hole sizes of one, two, three, and four inches were considered. Author

N72-16848 Pennsylvania State Univ., University Park.
FINITE BEAM ELEMENTS FOR DYNAMIC ANALYSIS
V. H. Neubert and H. Lee (Westinghouse Res. Labs., Pa.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 51-60 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390

Finite elements were developed to represent segments of Bernoulli-Euler beams for dynamic analysis. Massless beam elements, of bending stiffness EI, carry concentrated masses at internal points of the element and at its end points. The size and position of each mass is determined so that chosen dynamic quantities will be the same for the finite element as for the uniform beam. The mass matrix for the element is diagonal. Two approaches were used: (1) an impedance approach, in which the finite elements are devised so the impedance matrix relating moment, shear, slope and displacement at the ends of the segment is accurate and (2) a modal approach, in which shock effective mass, shear, bending moment, or natural frequencies are the quantities made correct for the lowest modes. Various boundary conditions are considered. Author

N72-16849 Missouri Univ., Rolla.
EVALUATION OF MODELS FOR ONE-DIMENSIONAL VIBRATION SYSTEMS
R. D. Rocke *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 61-79 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Several low frequency approximation techniques for use in describing vibrations of the one-dimensional continuum are evaluated. Three types of lumped parameter models and two approximate transmission matrix forms represent the approximations investigated. The main objective was to formulate some generalizations as to which models should be used in approximating the continuum, how they should be employed, and what accuracies can be expected upon using the models. The models which are based upon a close fit to the low frequency approximation of the exact transmission matrix at the segment level, are shown to be superior in predicting the principal mode frequency roots for an element composed on N segments. On this basis, an improved lumped parameter model and an approximate power series expansion transmission matrix are recommended for describing nonuniform elements. Author

N72-16850 Alabama Univ. Research Inst., Huntsville.
DYNAMIC ELASTOPLASTIC RESPONSE OF GEOMETRICALLY NONLINEAR ARBITRARY SHELLS OF REVOLUTION UNDER IMPULSIVE MECHANICAL AND THERMAL LOADINGS
T. J. Chung, J. T. Oden, R. L. Eidson, J. F. Jenkins, and A. E. Masters *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 81-88 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The finite element method is applied to dynamic, geometrically and materially nonlinear behavior of complex, thermoplastic structures subjected to impulsive mechanical and thermal loading. As a byproduct, the capability of predicting dynamic stability and postbuckling behavior of thermoelasto-plastic shells is also obtained. Numerical integration of the equations of motion and heat conduction for the discrete model is performed by the use of parabolic acceleration and cubic displacement methods. A technique for evaluating impulsively-introduced buckling loads is proposed. Numerical examples include the dynamic response of an impulsively loaded elastoplastic spherical cap. Author

N72-16851 Naval Civil Engineering Lab., Port Hueneme, Calif.
RIGID BODY MOTIONS OF ELASTICALLY RESTRAINED UNDERWATER STRUCTURES FROM DETONATION-INDUCED SHOCK
H. S. Zwibel and J. G. Hammer *In* Shock and Vibration Inform Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 89-107 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The incident shock wave attenuate exponentially in time with various decay constants. Results are presented for two extreme cases: An extremely long time constant (i.e., a step pulse), and a short time constant (a pulse that decays by a factor of e/1 in a half transit time). Rough estimates indicate that the viscous forces per se are negligible. Changes in the flow pattern induced by the viscosity may have a significant effect on the latter phases of the motion. This will not appreciably affect the peak acceleration, which occurs within half a transit time. The solutions for the spherical and cylindrical structures are obtained by solving for the Fourier transform of the structure displacement. This transform is analytically invertable for the spherical structure. To evaluate the accuracy of the numerical inversion procedure, a comparison between the numerical and exact solutions for the sphere is presented. Author

N72-16852 Florida Univ., Gainesville.
EXTENSION OF CLASSICAL BINARY FLUTTER MODEL USING ROOT LOCUS c12
J. C. Hornbuckle and R. L. Sierakowski *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 109-121 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Myklestad's method for coupled flexure-torsion vibrations is modified to include aerodynamic effects of a uniform airstream. Use of quasi-static aerodynamics includes aerodynamic damping. Boundary conditions are used to derive a root locus equation for the binary flutter model. Expressions for divergence and flutter conditions are derived from the analytical root locus. Both a degenerate case and typical example are included. Author

N72-16853 Louisville Univ., Ky.
STIFFNESS AND MASS MATRICES FOR A TRIANGULAR ELEMENT
Mario Paz and Earl Berry, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 123-129 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The stiffness and mass matrices for a triangular plane element are obtained explicitly for both cases, plane stress and bending of plates. In deriving these matrices, area coordinates are used which simplify the required integrations. The results are given in functional indices notation for easy computing programming. Author

N72-16854 Bell Helicopter Co., Fort Worth, Tex.
HELICOPTER FUSELAGE VIBRATION RESPONSE ANALYSIS USING THE HYBRID COMPUTER c02
James D. Cronkhite *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 131-139 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The hybrid computer method is described as an efficient and accurate design calculation tool enabling the dynamicist to accurately assess the effects of vibration control techniques, such as absorbers, suppressors, pylon isolators, and structural parameters during the preliminary design stage. The use of the analytical method in treating a typical design problem is shown, along with effects of antivibration measures. Author

N72-16855 Argonne National Lab., Ill.
VIBRATION OF A CLASS OF NONCONSERVATIVE SYSTEMS WITH TIME-DEPENDENT BOUNDARY CONDITIONS
Shoei-sheng Chen *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 141-150 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The response of an elastic system subjected to nonconservative forces and time-dependent boundary excitations is considered. The method of analysis is based on the separation of the original problem into static and dynamic problems. The static problem is solved by conventional methods while the dynamic problem is solved by utilizing the eigenfunctions and adjoint eigenfunctions intrinsic to the system. To illustrate the method, a cantilevered tube conveying fluid is studied. Author

N72-16856 Lockheed Missiles and Space Co., Sunnyvale, Calif.
A VARIATIONAL APPROACH TO THE FLUID-SHELL DYNAMIC INTERACTION PROBLEM c12
A. S. Benson *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 151-168 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A method of approach is developed for fluid modelling for the modal analysis of partially filled shells. The fluid is assumed to be inviscid and incompressible but not explicitly irrotational. The basis for the approach is the hypothesis that, since fluid shear is excluded, no mechanism exists for a cycle exchange of rotational kinetic energy and potential energy. Thus in a normal mode analysis, if a chosen form of solution includes rotation, such motion will occur in zero-frequency vortex modes with the remainder of the modes being of essentially irrotational character. Author

N72-16857*# Southwest Research Inst., San Antonio, Tex.
EQUIVALENT MECHANICAL MODEL OF PROPELLANT FREE-SURFACE VIBRATIONS IN THE SATURN S-IVB WORKSHOP CONFIGURATION
Franklin T. Dodge and Luis R. Garza *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 169-180 refs (See N72-16842 07-32)
(Contract NAS8-21478)
(NASA-CR-125448) Avail: NTIS; Director, Navy Pub. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

A methodology is presented that employs forced vibration testing of geometrically scaled tanks and that is capable of experimentally determining not only the mechanical model parameters for a given slosh mode, but also of locating the model and its line of action. Using this methodology, a mechanical model for the Saturn S-4B workshop is derived that includes eleven lateral modes, a rotary inertia mode, and slosh modes induced by roll excitation. Author

N72-16858*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF LIQUID OSCILLATIONS ON THE LM PROPELLANT QUANTITY GAUGE SYSTEM c14
M. Rimer and D. G. Stephens *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 181-194 refs Prepared in cooperation with Grumman Aerospace Corp., Bethpage, N. Y. (See N72-16842 07-32)
(NASA-TM-X-67491) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 14B

Both analytical investigations and an experimental program were carried out to understand and eliminate an early low-level fuel indication which is believed to have occurred on both the Apollo 11 and 12 flights. The problem is shown to be due to the main tank slosh modes coupling with the cylindrical column of fluid within the propellant quantity gaging system. The system equations and the similitude relationships required for extrapolating results to LM flight conditions are developed. Results are presented of response to both vibratory excitation and simulated worst case LM reaction control system inputs, which show good agreement between analysis and testing. The virtual elimination of the problem by the use of antislosh baffles is discussed. Author

N72-16859 North American Rockwell Corp., Downey, Calif. Space Div.
DERIVATION OF SKYLAB PROPELLANT STORAGE MODULE RANDOM VIBRATION ENVIRONMENT
A. E. Chirby, R. A. Stevens, H. C. Allen, and W. R. Wood, Jr. *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7, Dec. 1971 p 195-204 (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval

District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Acoustic and vibration tests were performed to qualify the PSM for the random vibration environment it experiences during ascent atmospheric flight. The acoustic tests also provided preliminary verification of the random vibration response predicted for the PSM shelf. In addition to criteria verification, the acoustic tests established the inputs used in the vibration qualification testing of the PSM on electromechanical shakers. The differences and similarities between the PSM's random vibration responses predicted by analysis and the PSM's responses measured during the acoustic and vibration tests are discussed. Author

N72-16860 California Inst. of Tech., Pasadena.
THE FLUTTER OF A HYDROFOIL c12
Thomas M. Ward and Raymond C. Binder (USC, Los Angeles, Calif.) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 7 Dec. 1971 p 205-213 refs (See N72-16842 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The results of a water tunnel investigation into the flutter characteristics of a low stiffness, fully submerged, subcavitating hydrofoil are presented. The foil was observed to flutter at a speed of approximately 22 ft/sec. Comparison of the experimental data is made with that obtained theoretically from an analysis based on a lumped element, two degree of freedom, typical section representation of the foil. Author

N72-16861 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN NO. 40. PART 5: DAMPING AND ISOLATION
Dec. 1969 312 p refs Proc. of the 40th Symp. on Shock and Vibration, Fort Monroe, Va. and Hampton, Va., 21-23 Oct. 1969 7 Vol.
(AD-723344; Bull-40-Pt-5) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20/11

Dynamic responses of aerospace structures to mechanical shock and vibrational damping are considered. The use of elastomeric damping materials in vibration isolators is projected. For individual titles, see N72-16862 through N72-16882.

N72-16862 Air Force Materials Lab., Wright-Patterson AFB, Ohio.
REDUCTION OF VIBRATIONS IN AEROSPACE STRUCTURES BY ADDITIVE DAMPING
David I. G. Jones, John P. Henderson, and Ahid D. Nashif *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 1-18 refs (See N72-16861 07-32)
(AF Proj. 7351)
(Task-735106) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Additive damping utilizing viscoelastic materials is considered from the point of view of its application to specific aircraft field vibration problems, including aircraft UHF and IFF antennas subjected to gunfire induced excitation, a chemically milled weapons dispenser web subjected to cavity resonance excitation and a remote compass transmitter subjected to aerodynamically induced excitation. In each problem, the effect of temperature on the performance of the damping treatment or device is emphasized and development procedures for optimum performance over the operational temperature range are discussed. Author

N72-16863 Barry Controls, Inc., Watertown, Mass.
VIBRATION ISOLATION WITH NONLINEAR DAMPING
Jerome E. Ruzicka and Thomas F. Derby *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 19-35 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Performance characteristics of single degree of freedom vibration isolation systems are discussed in which the isolator damping force is proportional to the relative velocity across the isolator raised to an arbitrary power. The concept of equivalent viscous damping is employed to develop a general equation for the equivalent viscous damping ratio which is used to determine approximate isolation system response parameters. A range of isolator damping nonlinearity is studied by varying the relative velocity exponent between 0.5 and 5 for a fixed value of damping. Detailed results for parametric variations in damping are presented for specific values of the relative velocity exponent that correspond to Coulomb, viscous, quadratic and cubic damping mechanisms. Author

N72-16864 Imperial Coll. of Science and Technology, London (England).
THE CONTROL OF VIBRATIONS WITH VISCOELASTIC MATERIALS
P. Grootenhuis *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 37-48 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The resonant response of beams and plates excited in bending modes of vibration can be reduced by increasing the damping, either by applying an unconstrained viscoelastic layer or by making a three-layer sandwich construction. In both techniques the optimum damping is dependent upon the frequency and thickness ratio of the layers. The results of computation for geometrically symmetrical beams with 3 and 5 layers and for the 4-layered beam construction are presented. It is shown also that the unconstrained layer technique can equal the 4-layered construction in damping effectiveness only when the modulus of elasticity of the damping layer is of the same order of magnitude as for metals. Author

N72-16865 Lockheed-California Co., Burbank.
SONIC FATIGUE RESISTANCE OF STRUCTURES INCORPORATING A CONSTRAINED VISCOELASTIC CORE
M. D. Lamoree and W. L. LaBarge *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 49-60 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Results of acoustic tests on specimens representative of typical aircraft structure and on specimens with skin panels containing a constrained layer of viscoelastic material are presented. The reduction in the structural response levels to acoustic excitation due to the added damping is correlated with theory. The effects of various joint designs on the sonic fatigue life of the panels are discussed. Author

N72-16866*# International Harvester Co., San Diego, Calif. Solar Div.
EXPERIMENTS ON INELASTIC DAMPING OF SPACE VEHICLE DUCTS
G. E. Bowie, W. A. Compton, and J. V. Long *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 61-92 refs (See N72-16861 07-32)
(Contract NAS8-21128)
(NASA-CR-125410) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

Response and fatigue results demonstrate that application of a uniform damping sleeve to a uniform duct yields a

substantial reduction in midspan maximum strain amplitude of a duct vibrating in the fundamental bending mode. This configuration is not recommended for use on full-scale structures because it can result in an undesirable length distribution of maximum strain amplitudes. Modifications could be made in the sleeve geometry that would retain the desirable reduction in mid-span response without introducing strain concentrations. Evaluation of additional sleeve configurations could be accomplished as a logical extension of the experience gained. Author

N72-16867 International Business Machines Corp., Rochester, Minn. IBM Systems Development Div.
TRANSVERSE VIBRATIONS OF LAMINATED PLATES WITH VISCOELASTIC LAYER DAMPING
Fakhruddin Abdulhadi *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 93-104 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A general analysis is presented for three-layer plates consisting of two distinct plate type facings and a core that carries shear stresses only. The governing equations are uncoupled to yield a sixth order partial differential equation representing the transverse motion. This equation is easily modified and used to obtain the frequency and composite loss factor equations for composites containing a constrained damping layer or nonconstrained damping layer with or without a spacer. A method is indicated to find the natural frequencies and the corresponding composite loss factors for various boundary conditions when the properties of the damping layer are temperature and frequency dependent. The response of a simply supported plate to a uniform harmonic load is found. The root mean square of the velocity amplitude is plotted against the forcing frequency to show the effect of damping. Author

N72-16868 Lord Mfg. Co., Erie, Pa.
COMPARISON OF THE GEIGER THICK PLATE TEST AND THE VIBRATING COMPOSITE BEAM TEST FOR THE EVALUATION OF THE EFFECTIVENESS OF VIBRATION DAMPING MATERIALS
D. R. Blenner and T. J. Dudek (Gen. Tire and Rubber Co., Akron) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 105-114 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The Geiger thick plate test and the vibrating composite beam test for the evaluation of vibration damping materials are briefly reviewed and the advantages and disadvantages of both methods are analyzed. The results of damping tests conducted on composite plate and beam test samples coated with the same damping material are compared and shown to agree within about 20%. The composite beam test method is shown to offer more advantages than the plate test method as it is now run. Material properties obtained from the beam test can be used to estimate the vibration response of damped structures and plates of arbitrary geometry. Author

N72-16869 Southwest Research Inst., San Antonio, Tex.
AN AEROSPACE ENERGY ABSORBER APPLIED TO HIGHWAY SAFETY
William E. Woolam *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 115-133 refs (See N72-16861 07-32)
(Contract DOT-FH-11-6863)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A fragmenting tube energy absorber was selected to be used in conjunction with highway bridge rails. The overall objective of the energy absorbing bridge rail is to provide additional cushioning for an automobile above that of a conventional bridge rail and at the same time accomplish a redirecting effect. A secondary objective of the energy absorbing bridge rail is to provide a stiff backup rail system which prevents penetration of a large truck or bus and hopefully redirects the vehicle. The fragmenting tube type energy absorber is described and its final application to the redirectional, energy absorbing bridge rail is illustrated. Author

N72-16870 Hughes Aircraft Co., Culver City, Calif.
DETERMINATION OF COMPLEX MOBILITY AND IMPEDANCE MATRICES FOR DAMPED LUMPED PARAMETER LINEAR DYNAMIC SYSTEMS
John J. Engblom *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 135-146 refs (See N72-16861 07-32)
Avail: Director, Navy Publ., and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Expressions for the mobility and impedance matrices for damped lumped parameter linear dynamic systems have been developed utilizing a normal mode approach. Modal and drive point reduction techniques have been included in order to minimize computation time. It is shown that certain reduction combinations result in a singular mobility matrix for which the impedance matrix does not exist. It is concluded, therefore, that the approach to mathematical modeling is dependent upon whether or not an impedance solution is desired. A simple example is presented which compares the results using this methodology to those for a distributed mass system. Author

N72-16871*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WAGGING TAIL VIBRATION ABSORBER
R. G. Barclay and P. W. Humphrey *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 147-155 refs (See N72-16861 07-32)
(NASA-TM-X-67585) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

A 750-foot cantilever length of extendible-tape boom (very low stiffness) was considered as the main system to be damped. A number of tail lengths were tried from 20 feet to 80 feet after which 40 feet was investigated further as a desirable compromise between performance and practical lengths. A 40-foot damping tail produced a damping effect on the main boom for the first mode equivalent in decay rate to 3.1 percent of critical damping. In this case the spring-hinge and tail were tuned to the main boom first mode frequency and the hinge damping was set at 30 percent of critical based on the tail properties. With this same setting, damping of the second mode was .4 percent and the third mode .1 percent. Author

N72-16872 TRW Systems, Redondo Beach, Calif.
A SIMPLE DEVICE FOR ATTENUATION OF LONGITUDINAL ELASTIC STRESS WAVES
J. P. ONeill and C. J. Tirman *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 157-174 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A simple practical method has been developed which significantly reduces the magnitude of longitudinal shocks such as stress waves traveling along a tube caused by striking the end. A damping collar was developed, tested and proved effective by laboratory programs; it was also substantiated by an analytic model of the test configuration. The basic device consisted of a circumferential collar surrounding a steel pipe. The collar was attached by means of a viscoelastic interface. Utilizing the inertia of the collar mass to apply shear loading through the viscoelastic material, it was possible to reduce the magnitude of

the shock waves in the pipe by as much as 24 times for the configurations tested despite the very small displacements associated with longitudinal shock motion (and hence small relative motion across the damping layer). Author

N72-16873 Naval Ordnance Lab., White Oak, Md.
ANALYSIS OF SHOCK MITIGATION FOR GLASS SUBMERSIBLES
Jackson C. S. Yang *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 175-190 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Equations are developed to obtain the response of models of deep submergence glass hulls clad with a viscoelastic strain attenuating material which are subjected to impact loading. Combined stresses in the glass hull, cladding deflection, cladding velocity, impact force and duration of impact are calculated. Experiments were performed using an air gun to impact steel spherical projectiles on strengthened glass hemispherical shells with Adiprene cladding which was considered to be elastic within the range of the strains developed. Reasonable agreement between the results of the theoretical analysis and the experimental data was obtained. Author

N72-16874 Boeing Co., Philadelphia, Pa.
REDUCTION IN VIBRATION OF THE CH-47C HELICOPTER USING A VARIABLE TUNING VIBRATION ABSORBER
c02
James J. OLeary *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 191-202 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

An absorber with a variable tuning capability was developed, designed, bench tested and flight tested successfully in the CH-47C. A control system to make this variable tuning absorber self tuning was incorporated and successfully demonstrated. Because of this development the CH-47C helicopter can operate over a range of rotor speeds with no adverse effect on the acceptability of the primary airframe vibration. Author

N72-16875*# Barry Controls, Inc., Watertown, Mass.
RESPONSE AND OPTIMIZATION OF AN ISOLATION SYSTEM WITH RELAXATION TYPE DAMPING
Thomas F. Derby and Peter C. Calcaterra *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 203-216 refs (See N72-16861 07-32)
(Contract NAS1-8465)
(NASA-CR-125411) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

The effect of damping on the impulse response and random vibration response of mechanical isolation systems which incorporate elastically coupled damping elements is considered. Response quantities are the acceleration of mass and deflection of the isolator, with the acceleration of the base as input. Optimum values of the system parameters are defined for each case. Recommendations are made for selecting values of parameters other than those optimized according to the chosen performance criteria. All the results are presented graphically in the form of dimensionless ratios. Author

N72-16876 IIT Research Inst., Chicago, Ill.
THE RESPONSE OF MECHANICAL SHOCK ISOLATION ELEMENTS TO HIGH RATE INPUT LOADING
Ronald L. Eshelman and P. Nagaraja Rao *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 217-234 refs (See N72-16861 07-32)
(Contract F04694-67-C-0076)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The response of mechanical shock isolation elements to high rate input loadings was studied analytically and experimentally with special emphasis on high frequency effects. The shock isolation elements were tested in a closed loop electrohydraulic test machine with a shock isolation system simulation test fixture. Finite difference equations, programmed on the digital computer, were utilized to calculate the response of the isolator-mass systems. The mechanical shock isolation elements examined experimentally and analytically were helical spring, ring spring, friction snubber, pneumatic spring, liquid spring, and solid rubber elastomer. Author

N72-16877 North American Rockwell Corp., Los Angeles, Calif.
RATIONAL ANALYSIS OF A TWO DEGREE OF FREEDOM FLEXURE TORSION SYSTEM FOR REDUCTION OF CERTAIN TYPES OF FLUTTER
Martin J. Klepl and Raymond C. Binder (Univ. of Southern Calif., Los Angeles) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 235-244 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The study of flutter is the study of the roots of the frequency equation. A novel method of obtaining the roots and evaluating how the parameters affect the roots constitutes the subject matter of this paper. The frequency equation of the two-degree-of-freedom flutter model is derived to cast it into a particular form. The roots of this suitably formulated frequency equation are graphically obtained by the root locus method. The advantage of this method is that the influence of system parameters in the two branches of the frequency-velocity plot is readily evaluated. Three closed-form solutions of the frequency equation are obtained by suitable assumptions on the parameters. In the conclusion, concrete suggestions are made to reduce flutter. Author

N72-16878 IIT Research Inst., Chicago, Ill.
DESIGN AND DEVELOPMENT OF A SHOCK ISOLATION EVALUATION SYSTEM FOR HIGH RATE INPUT LOADING
P. N. Rao and K. E. Hofer *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 245-260 (See N72-16861 07-32)
(Contract F04694-67-C-0076)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

For the evaluation of the response of shock isolation elements or materials, the primary requirement is to develop a system capable of simulating the load input to which the elements are subjected. Equally important is the physical configuration of the system amenable to handle a variety of isolators and isolation materials. Further, it is necessary to incorporate a suitable mass or structure system to facilitate measurement of shock mitigation. Such a complete system was developed and proved to be highly versatile in experimentally evaluating responses of the following shock isolators and materials: helical spring, ring spring, friction snubber, pneumatic spring, liquid spring, polyurethane polyether foams and solid elastomers. Author

N72-16879 Brown Engineering Co., Inc., Huntsville, Ala.
A STUDY OF AMPLITUDE FREQUENCY PLOTS WITH NONLINEAR DAMPING
Glen F. Brammeier *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 261-275 refs (See N72-16861 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard,

Washington, D. C. 20390; $15.00/set

The Saturn V Dynamic Test Vehicle has been shown to be extremely sensitive to excitation force levels during certain phases of experimental yaw testing. After reviewing the test data it was concluded that a curve fitting technique should be developed to obtain nonlinear modal equations. Various forms of damping and nonlinear stiffness were substituted into the modal equation of motion. Differences between the shape of the amplitude frequency response plots were obtained using the analytical method of Klotter. Techniques are discussed for determining which damping assumption best fits a particular set of experimental data points. Author

N72-16880 Oklahoma Univ., Norman. School of Aerospace and Mechanical Engineering.

VIBRATIONS OF MULTICORE SANDWICH BEAMS

Vincent P. Roske, Jr. and Charles W. Bert *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 277-284 refs (See N72-16861 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A vibrational analysis of a sandwich beam with multiple cores is reported. The linear equations of motion for a two-core beam are uncoupled and solved by the classical-differential-equation approach. It is assumed that the facings are thin and identical and that the cores resist shear only, but may be of different materials. To evaluate the theory, a cantilever sandwich beam was built with three fiberglass facings and two cores, one of fiberglass honeycomb and the other of aluminum honeycomb. Theoretical and experimental results agreed within four percent for the two lowest natural frequencies.

Author

N72-16881 North American Rockwell Corp., Los Angeles, Calif.

THE USE OF POLYURETHANE FOAM FOR SHOCK AND VIBRATION ISOLATION OF AVIONIC COMPONENTS

W. E. Arthur, T. Carrell, and J. Nirschl (Army Electron. Command, Fort Monmouth) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 285-289 refs (See N72-16861 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390; $15.00/set

A special shock and vibration isolator, using polyurethane foam, was developed for use in the aerial radiac system to isolate a taut band meter from severe vibrations. The mount showed excellent vibration isolation properties and other sources indicated excellent shock attenuation. The actual data recorded in the test program are reported as well as the construction details of the polyurethane isolator. Author

N72-16882 IIT Research Inst., Chicago, Ill. Mechanics of Materials Div.

THE ANALYTIC MODELING OF OPEN CELL FOAMS AS SHOCK AND VIBRATION ELEMENTS

Theodore Liber and Howard Epstein (Minn. Univ., Minneapolis) *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. no. 40, pt. 5 Dec. 1969 p 291-305 refs (See N72-16861 07-32)

Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Foams have been extensively used for applications in shock isolation and to a lesser degree in vibration isolation. These applications have been based largely on semi-empirical methods. Described is a model for the foam, procedures for experimentally determining the parameters of the model are established, and analytic to experimental results are compared. Author

N72-16883 National Lending Library for Science and Technology, Boston Spa (England).

THE UNSTABLE FLEXURAL BEHAVIOUR OF INFLEXIBLE ELASTO-PLASTIC BEAMS

G. Maier 10 Nov. 1971 23 p refs Transl. into ENGLISH from Rend. Ist. Lombardo Sci. Lett., A (Italy), v. 102, 1968 p 648-677

(NLL-Lib-Comm-1618-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Beams subjected to bending in the elastoplastic range and their unstable behavior are examined using the theory of simple bending which presupposes the deformability laws governing one section to be absolutely independent of what is happening in other sections. This leads to the introduction of moment rotation relationships to describe unstable flexual behavior, removing the paradox arising from applying the curvature concept in cases where it loses importance. A simple statically indeterminate beam in bending is studied as the strain hardening/softening assumed for the plastic phase of flexural deformation is varied. For the change from strain hardening to plasticity and finally to strain softening in the constitutive laws, the following were observed: continuity of variation in the overall structural behavior; accompanying reduction in maximum load; and appearance first of normal instability and then, with release of increasing elastic energy, of intrinsic instability phenomena. Author

N72-16884# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

OPTIMAL PLASTIC DESIGN OF DOUBLY SYMMETRIC CLOSED STRUCTURES

S. C. Batterman and L. P. Felton May 1971 39 p refs (TAE-126) Avail: NTIS

Optimal plastic design of doubly symmetric closed ring and frame structures of idealized sandwich section is formulated utilizing the Marcal-Prager optimization method. Detailed results are presented for elliptical rings and rectangular frames under uniform internal pressure. As the design load increases, the elliptical ring requires consideration of two optimal design configurations while the rectangular frame requires considering eight distinct possible design configurations. Curves of total cost as a function of design load are presented and results for pure bending are obtained as special cases. Author

N72-16885*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MECHANICS OF LOAD TRANSFER AT THE FIBER/MATRIX INTERFACE

Christos C. Chamis Washington Feb. 1972 64 p refs (NASA-TN-D-6588; E-6447) Avail: NTIS CSCL 20K

Methods for measuring and predicting interface bond stresses and interface bond strength are described. Geometric and material variables which influence interface stress and interface bond strength are identified. The dependence of composite fracture surface characteristics on bond strength is illustrated. Parameters for selecting constituents to yield specified interface bond strength are recommended. Author

N72-16886# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

PLASTIC DEFORMATION OF TANTALUM CARBIDE UP TO 2200 C

Jean-Luc Martin 1971 10 p refs In ENGLISH and FRENCH Presented at the 5th Intern. Symp. on Mater., Berkeley, Calif., 13-17 Sep. 1971

(ONERA-TP-1005) Avail: NTIS

Bending experiments were performed on thin sheets of TaC(1-x), together with electron microscope observations. These observations revealed dislocation splitting in TaC(1-x), the stacking fault energy of the carbide increasing when x decreases. Results of the bending tests were analyzed in terms of a strain rate law, and were interpreted on the basis of a model of carbon diffusion-assisted dislocation glide. Author

N72-16887# Lockheed Missiles and Space Co., Palo Alto, Calif.

THERMOPLASTICITY UNDER VARIABLE LOADINGS

Yu. N. Shevchenko [1971] 74 p Transl. into ENGLISH

of "Termoplastichnost pri Peremennykh Nagruzheniiakh" Kiev, Naukova Dumka Press, 1970
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Methods of determining the elastoplastic stress state of separate components executed in the form of thin-walled plates and shell, subjected to a single active loading, were studied. Questions of multiple, isothermal loading in conformity with the theory of small elastoplastic deformations were also investigated. Under the multiple loading accompanying nonuniform heating with the resultant change in the mechanical characteristics, the behavior of an elastoplastic system differs substantially from its behavior under isothermal multiple loading. Plasticity domains, which go partially over the unloading domains, appear in thin plates and shells subjected to nonuniform heating. Author

N72-16888# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
APPLICATION OF TRANSFER MATRIX METHOD TO THE STRUCTURAL DYNAMICS OF ROCKET VEHICLES
Akira Nakano Nov. 1971 33 p refs
(ISAS-472-Vol-36-14) Avail: NTIS

Some aerospace applications of transfer matrix method are presented. When the structural dynamics of rocket vehicle are analyzed, the lumped parameter system which represents original vehicle, has been widely used. The distribution of properties of actual vehicle, such as mass or bending rigidity, have numerous discontinuities along the longitudinal axis, therefore the accuracy of computation mainly depends on the number of lumped parameters. Transfer matrix method is considered to be suitable to analyze a one dimensional structure such as the body of the vehicle, because the order of matrix is not affected by number of discrete elements on which the accuracies of computation depend. The transfer matrix method is applied to the vibrational analysis of rocket vehicle. By utilizing this method, it is shown that axial force or aerodynamic lift force could be incorporated into the system, and then applied to other aerospace problems such as aeroelastic divergence. Author

N72-16889# Bendix Corp., Kansas City, Mo.
STRESS ANALYSIS OF THICK WALL ORTHOTROPIC SPHERICAL VESSELS
G. W. Forman 11 p [1971]
(BDX-613-137) Avail: NTIS

Radial and tangential stresses present in spherical vessels in which the wall thickness is not necessarily small as compared to the inner radius are considered. The analysis presented here assumes that the material properties in the radial and tangential directions may be different, as would be the case in a filament-wound sphere. If the winding process is such that the fiber is placed on essentially greatcircles, and such that near equal angular dispersion of the fiber exists at any point, the material will have constant properties in any tangential direction. Thus, two only characterizing directions (radial and tangential) suffice in defining the strength and elastic properties of the semi-orthotropic material. Author

N72-16890# Bendix Corp., Kansas City, Mo.
STRETCH EFFECTS ON LOAD DEFLECTION AND THICKNESS OF Y-3333 CELLULAR SILICONE SLABS
Interim Report
P. H. Aldrich Aug. 1971 51 p
(Contract AT(29-1)-613)
(BDX-613-360-Rev.; PDO-6984549) Avail: NTIS

The effects of stretch on the thickness and compressive load deflection of Y-3333 (Union Carbide formulation) thin cellular silicone slabs were investigated. It was determined that unidirectional stretch up to 5.0 percent during testing does not produce load deflection or thickness variations of any consequence. At stretch values greater than 10.0 percent, an appreciable reduction in both thickness and compressive load deflection was observed. Author

N72-16891# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
TRESS: A FINITE ELEMENT CODE FOR STRESS ANALYSIS PROBLEMS
W. D. Collier, J. P. Ellington, and P. M. Rees 1971 77 p refs
(TRG-1813(R); UDC-624.042; SBN-85356009-9) Avail: AEC Depository Libraries

The program TRESS has been written to enable stress analysis of two dimensional bodies of complex shape to be carried out. The plane (XY) or axi-symmetric (RZ) shape is broken up by the user into triangular elements. The vertices and edges of the elements are referred to as nodes and connections. For complex geometries, the input of nodes and connections may be aided by an automatic mesh generation facility. Loading cases are presented to the program in terms of loads in both coordinate directions at each of the nodes. The program then calculates displacements at each of the nodes and the resultant stresses in the elements. The present version of the program treats problems of up to one thousand nodes. Author

N72-16892# Southampton Univ. (England). Inst. of Sound and Vibration Research.
FREQUENCY RESPONSE OF STRUCTURES EXCITED BY TRANSIENT OR RANDOM FORCES USING CROSS CORRELATION AND ITS LAPLACE TRANSFORM
F. Kandianis Aug. 1971 88 p refs Sponsored by Min. of Defence
(ISVR-TR-47) Avail: NTIS

The frequency response of a structure at one station with reference to its response at another station is investigated. The work is aimed at: (1) the application of statistical concepts to the analysis of transient processes based on a modified definition of the correlation function, and (2) the use of the Laplace transform in obtaining the structural frequency response. The effect of the limited frequency bandwidth of the excitation of th frequency response function estimate is considered. Transie tests on discrete systems and continuous structures demonstrate the theory and analysis techniques developed. Author (ESRO)

N72-16893 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION BULLETIN, NO. 41. PART 6: DYNAMICS, DYNAMIC STRESS ANALYSIS
Dec. 1970 226 p refs Presented at the 41st Symp. on Shock and Vibration, AF Academy, Colo., 27-29 Oct. 1970
(AD-723351; Bull-41-Pt-6) Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20/11

Papers presented at the 41st Symposium on Shock and Vibration are reviewed. Presentations emphasized dynamic response, structural analysis, stress analysis, dynamic and static loading, vibration environments, matrix methods, finite element methods, and computer methods. For individual titles, see N72-16894 through N72-16915.

N72-16894 Air Force Academy, Colo.
***PARAMETRIC RESPONSE OF MONOSYMMETRIC* IMPERFECT THIN-WALLED COLUMNS UNDER SINUSOIDAL LOADING**
Stanley G. Ebner and Martin L. Moody (Colo. Univ., Denver) *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 1-8 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The vibrational response and dynamic stability of thin walled columns with initial crookedness and twist were investigated. The columns were simply supported, of low torsional stiffness, and the cross sections of the columns had a single plane of symmetry. The columns were subjected to a constant plus a harmonic longitudinal load which caused

parametric vibrations. Partial differential equations were solved by separation of variables and an analog computer. The unstable regions in the plane of the loading and frequency parameters were located using analog computer technique. Typical amplitude time responses of the two transverse modes and the torsional mode are presented which clearly show the subharmonic, harmonic, and superharmonic frequencies characteristic of the Mathieu equation. Amplitude response spectra are also included. Author

N72-16895 McDonnell-Douglas Astronautics Co., Santa Monica, Calif.
PREDICTION OF UPSTAGE RANDOM VIBRATION ENVIRONMENT USING A STATISTICAL ENERGY APPROACH
D. E. Hines, G. R. Parker, and R. D. Hellweg *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 9-30 refs (See N72-16893 07-32)
(Contract DAAH01-68-C-1237)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The Statistical Energy Approach (SEA) was used to predict the UpSTAGE high frequency vibration environment. This approach allowed the analysis to account for the high level local excitation induced by the control system, the unique shape of the vehicle, and the internal configuration of the vehicle. The topics discussed are: (1) development of the SEA as used on UpSTAGE; (2) development of the analytical models; (3) discussion of the tests performed to support the analysis; (4) prediction of the flight levels for the UpSTAGE vehicle. Author

N72-16896 Maryland Univ., College Park.
ON THE REDUCTION AND PREVENTION OF THE FLUID-INDUCED VIBRATIONS OF CIRCULAR CYLINDERS OF FINITE LENGTH
Dirse W. Sallet *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 31-38 refs Prepared in cooperation with NOL, White Oak, Md. (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A method which prevents the unsteady pressure distribution around a circular cylinder, and thereby eliminating the fluid induced vibrations, is described. Author

N72-16897 Army Weapons Command, Rock Island, Ill.
EFFECTS OF LOOSENESS ON DYNAMIC BEHAVIOR
R. E. Beckett (Iowa Univ.), K. C. Pan, and D. D. Penrod *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 39-45 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A numerical solution is given for the motion of a mass that is forced to vibrate between two springs which allow some free travel at the center. Viscuous damping was considered. Results are presented in the form of amplification curves which are plotted against a dimensionless excitation frequency. Author

N72-16898*# Duke Univ., Durham, N.C.
DYNAMIC DEFLECTIONS OF MULTI-SPAN GUIDEWAYS UNDER HIGH SPEED, AIR CUSHION VEHICLES c02
James F. Wilson *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 47-60 refs (See N72-16893 07-32)
(Grant NGL-34-001-005; Contract DOT-FR-00037)
(NASA-CR-125446) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 01B

Series solutions are presented for dynamic responses of elevated quideways to high speed vehicles. The quideways are modeled as identical, end to end Bernoulli-Euler beams, each simply supported at the ends. Influence functions are presented for the deflections resulting from a point force traversing a span with any number of internal rigid props, with explicit results for the single-span, two-span (one prop) and three-span (two prop) cases. Superposition of influence functions is used to obtain responses for the multiple loading of traversing air cushion vehicles. Numerical results include peak deflections and bending moments of simple spans in response to a variety of loading. Ratios of maximum dynamic to maximum static deflections and bending moments at midspan approach 2.0 for long, continuous loadings, but are as high as 3.2 for certain segmented loadings which overlap two spans at once. Parametric studies show that, for a given span, the vehicle speeds at which these peak responses occur are always quite different than the critical speed for a point load. Author

N72-16899 Air Force Academy, Colo. Dept. of Engineering Mechanics.
ANALYSIS OF THE MOTION OF A LONG WIRE TOWED FROM AN ORBITING AIRCRAFT
S. A. Crist *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 61-73 refs (See N72-16893 07-32)
(Contract N00014-66-C-0357; Task-NR321-013)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A lumped mass model of a long trailing wire antenna is presented and Lagrange's equations of motion derived. These equations were solved numerically for the case of vertical aircraft oscillations in a constant radius and altitude orbit. A slack condition was found at the drogue for certain magnitude oscillations. The equations were also solved for the case of aircraft transition from orbit to straight and level flight. Both tension at the aircraft and instantaneous positions of the cable are presented. Author

N72-16900 Holmes and Narver, Inc., Las Vegas, Nev.
A POSTSHOT STUDY OF THE DYNAMIC RESPONSE OF THE LASL MOBILE TOWER DURING THE PLIERS EVENT
R. E. Backman, E. F. Smith, and R. P. Kennedy *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 75-86 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The LASL mobile tower, an eight-story steel space truss structure with a combined dead load of approximately 495 kips, was positioned at surface zero during the Pliers underground nuclear event. Accelerometers measured a vertical ground shock exceeding 4 g's and subsequent tower responses exceeding 10 g's. Measured relative displacements at points on the tower were compared with those computed analytically using the measured ground shock as the input motion. The nonlinear effect of tower jumping was included in the analysis. Comparisons indicated that the time history response of tower structures could be accurately predicted provided the input motion time history can be reliably predetermined. The data reduction and dynamic analysis are described. Author

N72-16901*# Alabama Univ., Huntsville.
BOUNDS FOR THE RESPONSE OF A CONSERVATIVE SYSTEM UNDER DYNAMIC LOADING
H. Brauchli *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 87-92 refs (See N72-16893 07-32)
(Grant NGL-01-002-001; Contract F44620-69-C-0124)

(NASA-CR-125447) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

A method based on Liapunov theory is presented to obtain bounds for the energy increase in a discrete conservative system subject to time-dependent loading. Applications to simple systems approximating a column and a circular arc are given. Author

N72-16902 Aerospace Corp., San Bernardino, Calif.
THREE DEGREE OF FREEDOM SPRING MASS EJECTION SYSTEM
R. Muskat *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 93-101 (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The problem of dispensing three objects by spring from a tube, subject to a set of optional constraints is solved. The required initial displacements and stiffnesses of each spring in a three spring-mass system are determined such that at a given instant of time a specified velocity for each mass is obtained. Due to the unusual boundary conditions, the solution is in the form of a transcendental equation in two unknowns. Since unique boundary conditions do not exist, a family of solutions are obtained. The desired condition occurs when the force in the springs at time zero is a minimum and the initial displacements and final stroke are within the physical constraints. Author

N72-16903 Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRUCTURAL DYNAMICS OF A PARABOLOIDAL ANTENNA c09
Myron L. Gossard and William B. Haile, Jr. *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 103-114 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

To study the dynamic behavior of a flexible parabolically curved antenna, finite element methods were used to generate inertia and stiffness coefficients that formed the basis of an eigenproblem for the natural frequencies and modes of the antenna. A preliminary Fourier decomposition of the problem was made in the antenna's circumferential direction. Thereby, two kinds of computational difficulty were avoided: (1) the large and unwieldy original problem was separated into a number of relatively small and independent problems; and (2) the need to cope with an R-fold redundant repetition of frequencies and modes that would ordinarily occur for the R-ribbed axisymmetric structure was removed. Author

N72-16904 Hercules, Inc., Wilmington, Del.
AN APPLICATION OF COMPONENT MODE SYNTHESIS TO ROCKET MOTOR VIBRATION ANALYSIS
F. R. Jensen and H. N. Christiansen (Brigham Young Univ.) *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 115-121 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Acoustic oscillations in a solid rocket combustion cavity produce accelerations on motor structure and attached components. The transmission of these loads to motor components was studied by a structural dynamics analysis of the aft dome for the Minuteman stage motor. Finite element models were constructed of the aft dome structure, the nozzle, and the nozzle control unit (NCU) and solutions were obtained using the SAMIS, Structural Analysis and Matrix Interpretative System, finite element computer program. Because of SAMIS computer program limitations and model complexity, it was decided to use a component mode synthesis technique to obtain solutions for the complete aft dome structure. Vibration tests gave natural frequencies of the NCU for the first lateral mode (23 Hz) and the first longitudinal mode (66 Hz) in reasonable agreement with calculated results, 30 and 71 Hz, respectively. The calculated frequency of the first lateral mode for the NCU was very sensitive to the fixity condition assumed. It was concluded that the observed pressure oscillations could be expected to excite major structural resonances. Author

N72-16905 Gibbs and Cox, Inc., New York.
COMPARISON OF CONSISTENT AND LUMPED MASS MATRIX SOLUTIONS WITH THE EXACT SOLUTION FOR A SIMPLY-SUPPORTED TIMOSHENKO BEAM
C. Baum, J. T. Higney, and A. Jenks *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 123-131 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

In order to determine the comparative accuracy of lumped mass and consistent mass (using McCalley's formulation) matrices, a series of test problems were solved and the solutions compared with the exact solutions for Timoshenko beams. The solutions were obtained for simply-supported beams of various L/D ratios and various levels of model complexity. The comparison was carried out for three criteria: frequency, midspan bending moment due to a velocity-shock and modal mass. The study indicated that a lumped mass matrix is a better mathematical model of a simply-supported beam than a consistent mass matrix of the same number of degrees of freedom when frequency is the primary criterion. The lumped mass matrix is less distinguishably better when comparing midspan bending moments. For the modal mass criterion the consistent mass matrix has higher accuracy. Author

N72-16906 Missouri Univ., Rolla.
APPLICATION OF APPROXIMATE TRANSMISSION MATRICES TO DESCRIBE TRANSVERSE BEAM VIBRATIONS
R. D. Rocke and Ranjit Roy *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 133-145 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A study was made of the application and accuracy of using approximate transmission matrices to determine principal modes of uniform and nonuniform continuous Bernoulli-Euler beam elements. The work emphasized three aspects of the approximate transmission matrices: obtaining the matrices to different levels of accuracy, evaluation of resulting error levels in principal mode frequency roots obtained via these matrices, and the application to determining the frequency roots for several cases of nonuniform beams. The approximate transmission matrix is obtained by expanding the differential equation which defines the transmission matrix in a Maclaurin series about the origin of a beam segment. This method as a model to the continuum, has been compared to commonly used lumped parameter models. These comparisons are based upon the principal mode frequency root errors and indicate the effect of the series truncation on the convergence of the frequency roots. Author

N72-16907 Pennsylvania State Univ., University Park.
MEASUREMENT OF MOMENT-CURVATURE RELATIONSHIP FOR STEEL BEAMS
V. H. Neubert and W. Vogel *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 147-157 refs Sponsored by Office of Naval Res. (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Results are presented of an experimental determination of the moment-curvature relationship for steel beams one inch wide and one-eighth inch thick. Data for a fully annealed steel and a tempered ground tool steel are reported. Specimens consisted of three parallel cantilever beams carrying a common tip mass. Tests were performed on a drop table shock machine at the Naval Research Laboratory. Accelerations of the tip mass were used to compute inertia forces and the resulting beam moments. Curvature was obtained by measuring strain at various stations on the beam. Typical accelerometer and strain records versus time are presented. Dynamic moment-curvature plots are compared with static curves. The results with respect to increased yield and time delay in initiation of unloading are discussed. Advantages and disadvantages of this type of test are considered. Author

N72-16908 Louisville Univ., Ky.
SELF-SYNCHRONIZATION OF TWO ECCENTRIC ROTORS ON A BODY IN PLANE MOTION
Mario Paz *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 159-162 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Rectilinear vibration required in some types of mechanical equipment such as feeders of conveyors may be produced by two synchronized motors having eccentric weights rotating in opposite directions. The condition for self-synchronization of the motors was investigated theoretically, and the conclusions of the analysis were corroborated by experiments. Author

N72-16909 Naval Ship Research and Development Center, Washington, D.C.
PROPAGATION OF THE ERROR IN COMPUTED FREQUENCIES AND MODE SHAPES RESULTING FROM A DISCRETE MASS REPRESENTATION OF UNIFORM, SLENDER BEAMS WITH VARYING HEIGHT-TO-LENGTH RATIOS
Francis M. Henderson *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 163-177 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The question of how accurately errors in frequencies and modes of transverse vibration (without shear or rotary inertia) resulting from an n-mass modeling of continuous, uniformly rectangular beams with free ends can be predicted using a knowledge of these errors for a single reference beam is discussed. Author

N72-16910 Teledyne Brown Engineering, Huntsville, Ala.
A DISCUSSION ON THE ANALYTICAL DYNAMICS, STRESS, AND DESIGN INTERFACES
Irvin P. Vatz *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 179-186 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The structural analysis work flow path for typical organizations is reviewed. Present practices are evaluated relative to future requirements. Discussed are: (1) effect of the analytical outputs on the efficiency of the design process; (2) effect of the analytical process on the efficiency of the finalized design; (3) ideal interface between dynamics analysis and stress analysis; (4) efficient use of dynamics analysis inputs by stress analysts; (5) meaning of structural design reliability; (6) cumulative history effect on the life of structures; (7) influence of all factors in determining the static equivalent of the dynamic load. Author

N72-16911*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DYNAMIC STRESS ANALYSIS IN A STRATIFIED MEDIUM
Jackson C. S. Yang *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 187-196 refs (See N72-16893 07-32)
(NASA-TM-X-67595) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

Stress waves generated in a structure consisting of alternating plane, parallel, isotropic, and homogeneous elastic layers by the application of pressure pulses of various shapes and duration were analyzed. The method of characteristics was employed to compute the transient stresses at various points in the structure. Numerical computations were made using both the Effective Modulus Theory, where the layered structure is replaced by a homogeneous, transversely isotropic material, and by following the stress wave through each layer in conjunction with appropriate procedures to satisfy the boundary conditions and interface conditions. Comparisons of the results using the two approaches are presented in several graphs and it is shown that the smoothness of the applied pressure pulse, the rise and unloading times, has far more influence on the reliability of the Effective Modulus Theory than the generally accepted concept that it depends on the duration of the pressure pulse. Author

N72-16912 Martin Marietta Corp., Denver, Colo.
COMPARISON OF STRUCTURAL LOADS: STATIC VERSUS DYNAMIC
Paul J. Jones and William J. Kacena, III *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 197-202 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

A method is presented for obtaining static equivalent loads for structures subjected to random excitation that yields stresses consistent with the dynamic condition. The technique for determining equivalent static loads applies specifically to normal mode analyses of lumped parameter systems. The governing equations are derived and an example structure consisting of a simple truss is analysed to illustrate the developed methodology. A comparison of the derived stresses for the equivalent static loads, and for other combinations of static loads, is presented to show the conservatism that this method eliminates. The method presented for determining static equivalent loads due to random excitation appears to be readily adaptable, with minor modifications, to existing dynamic response and finite element structural analysis programs. Author

N72-16913*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EGGSHELLING AND VIBRATIONS OF A HIGH SPEED SHAFT WITH NASTRAN ANALYSIS
Dennis J. Martin and William C. Walton, Jr. *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 203-209 (See N72-16893 07-32)
(NASA-TM-X-67596) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 20K

The NASA recently initiated a research investigation of methods of noise reduction in aircraft turbojet engines. Of particular interest was a high speed multistage axial flow compressor. An interesting coupling-shaft vibration problem was encountered in the design and operation of the system. The solution to the vibration problem revealed an eggshelling phenomenon, an unusual balancing procedure, and the corresponding analytical study of the complete system using NASTRAN provided excellent agreement with experiment and indicated the design changes required for the system. Author

N72-16914 Teledyne Brown Engineering, Huntsville, Ala.
PARAMETRIC STUDY OF A BEAM WITH A COMPOUND SIDE-BRANCH RESONATOR AS A DEVICE TO EVALUATE PRELIMINARY DESIGN LOADS
J. Roger Ravenscraft *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., No. 41, Pt. 6 Dec. 1970 p 211-217 refs (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

Modal displacement ratios of a simulated skin-mounted component system are presented. The results provide an understanding of the responses relative to a point on the skin, a point at the attachment of the component to the skin, and a point located at the centroid of the mounted component. This is accomplished through a finite element model of the beam and attached component. The component centroid is sidebranched off the beam by a pair of springs. This support system will permit: (1) three degrees of freedom to describe the motion of the component; and (2) a stiffened component beam interface element between the mounting attachment points on the beam simulated skin. This finite element model is then analyzed on the digital computer for various mass and stiffness values of the sidebranch. The parametric study of this simulated system is performed to show how the component parameter changes affect the modal displacement ratios. Author

N72-16915 Martin Co., Orlando, Fla. Structure Analysis Dept.
RAIL LAUNCHING DYNAMICS OF THE SAM-D SURFACE-TO-AIR MISSILE c31
Martin Wohltman, Leonard A. VanGulick, and Carlton H. Sutphin *In* Shock and Vibration Inform. Center (Defense) The Shock and Vibration Bull., no. 41, pt. 6 Dec. 1970 p 219-230 Prepared for Raytheon Co., Lexington, Mass. (See N72-16893 07-32)
Avail: Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set

The dynamic motions of a single-stage, surface-to-air missile launched from a container-canister are described. The missile and canister are each about 17 feet in length. Missile and canister diameters are 16 inches and 36 inches, respectively. The principal interface between the missile and canister is a 10 inch wide continuous rail contoured to the missile circumference. No mechanical parts, such as shoes interconnect the missile and the rails. The rocket motor provides the launching force. As the missile exits the canister, it picks up angular rate and position prior to the development of stabilizing aerodynamic forces. Requirements for the missile to fly through established target windows restrict the rate and position to be within specified magnitudes. The problem, usually called tipoff and mal launch, is to determine for this particular missile the angular rate and position as it exists from the canister. Author

N72-16916# Martin Marietta Corp., Denver, Colo.
THE EFFECTS OF SURFACE LAYER ON PLASTIC DEFORMATION AND CRACK PROPAGATION Semiannual Report
I. R. Kramer and A. Kumar Aug. 1971 70 p refs
(Contract DAAG46-70-C-0102; ARPA Order 180; DA Proj. 7400)
(AD-731825; AMMRC-CR-71-2/2) Avail: NTIS CSCL 11/6

The rate of crack propagation was measured in three materials -- aluminum 2014-T6, titanium (6Al-4V), and 4130 steel. Cyclic loading tests were performed at room temperature with the ratio of minimum to maximum stress intensity K sub min/K sub max = 0.25. Center-cracked and Ripling specimens were used for plane stress testing while compact tension (CT) specimens were used for plane strain testing. The effect of prestress and surface layer elimination treatment was investigated. A significant reduction in the crack propagation rate was observed with this treatment. The improvement was maximum at low stress intensity values both in plane stress and plane strain conditions. The optimum improvement was observed in specimens that were prestressed just below the yield and the surface removed. Author (GRA)

N72-16917# Illinois Univ., Urbana. Dept. of Theoretical and Applied Mechanics.
FRACTURE MECHANICS APPROACH TO ADHESIVE JOINTS
G. G. Trantina Aug. 1971 47 p refs
(Contract N00019-71-C-0323)
(AD-731992; UILU-ENG-71-60014) Avail: NTIS CSCL 13/5

The study investigates the problem of applying fracture mechanics to the opening mode fracture of a two-material (aluminum-epoxy-aluminum) system. The results of a finite element analysis of a two-material, single-edge-notch (SEN) plate are used with a compliance method in order to obtain strain energy rates, G, and with a displacement method to obtain stress intensity factors, K. Approximate relationships between the homogeneous system and the adhesive system for both K and G are determined. The relationship between K and G for the adhesive system is obtained. The experimental investigation provides an experimental compliance calibration for the same adhesive system and loading. Good reproducibility of the fracture toughness values obtained for the two-material system with SEN and tapered double cantilevered beams specimens indicates the geometry independence of the fracture toughness. The effect of the notch root radius and proper specimen preparation are also considered. Author (GRA)

N72-16918# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
ON THE RESPONSE OF ELASTIC PLATES BACKED BY ENCLOSED CAVITIES TO TURBULENT FLOW EXCITATIONS
Frank Obermeier Apr. 1971 48 p refs
(Contract N00014-67-A-0204-0002; SR Proj. 009-01-01)
(AD-732004; TR-70208-4) Avail: NTIS CSCL 20/11

The report concerns some special points of the basic mechanisms of sound generation and structure-borne sound due to the interaction between turbulent boundary layer flows and thin, elastic plates backed by cavities. In particular, the specific differences of the excitation by turbulent boundary layer flows compared with that by sound fields are discussed and the responses of the vibrating system in the case of the excitation of natural frequencies either of the plate or of the cavity are determined. Author (GRA)

N72-16919# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN APPROXIMATE THEORY FOR ELASTIC WAVE PROPAGATION IN MULTI-BAR MEDIA Ph.D. Thesis
James E. Wade Dec. 1970 268 p refs
(AD-732233; OS/MC/68-1) Avail: NTIS CSCL 20/11

The phenomena of elastic wave propagation in prismatic bars is investigated by use of the approximate theories. In addition to several structural configurations that are synthesized from rectangular bar elements, the free bar and a single rectangular bar with mass distributed over several faces are considered. The first-order approximate theory of elastic wave propagation, when applied to bar elements, results in a twelve component displacement field in irreducible triplicates of motion, when the product series of Legendre polynomials in the lateral coordinates are truncated at first order. New results in the frequency spectra are presented for each of the irreducible triplicates of motion for bars experiencing free motion. Frequency spectra are presented for rectangular bars with mass distributions on its lateral faces. The presence of the mass was found to lead in some cases to more coupling between the modes of propagation. Finally, a structural configuration is synthesized with five rectangular bar elements, each of different material but perfectly bonded together. The first order theory is applied to obtain the equations of motion for each bar, which are then coupled together through the equality of certain forces and displacements at the interfaces. Numerical results in the form of frequency spectra are presented for two and three bar configurations. The spectra demonstrate that it is possible to duplicate the behavior expected from a higher order approximate theory by use of the first order approximate theory with a sufficient number of finite bar elements. Author (GRA)

N72-16920# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE ANALYSIS OF TWO SIMPLE COMPOSITE STRUCTURES USING MECHANICAL ADMITTANCE METHODS M.S. Thesis
Ronald L. Bagley 7 Sep. 1971 118 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-732219; TN-1971-40; ESD-TR-71-262) Avail: NTIS CSCL 20/11

Mechanical admittance methods are applied to two simple composite structures. The mechanical admittance of the composite structures are predicted using the mechanical admittances measured on their constituent substructures. The effects of the suspension system on the measured admittances are estimated. Attention is devoted to the technique of analytically assembling substructures into a composite structure. Resonant frequencies and mode shapes of the composite structures are estimated from the predicted admittances. The effects of modal participation and damping on the estimated mode shapes and resonant frequencies are discussed.
Author (GRA)

N72-16921# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
AXIALLY SYMMETRIC TRANSIENT WAVE PROPAGATION IN ELASTIC RODS WITH NONUNIFORM SECTION
P. C. Y. Lee and Y. S. Wang Sep. 1971 53 p refs Prepared in cooperation with Princeton Univ.
(AD-731280; RE-415; RR-71-1) Avail: NTIS CSCL 20/11

A one dimensional approximate theory is derived for an elastic circular rod with nonuniform cross section. Three coupled equations, taking into account the longitudinal, radial, and axial shear deformations and their inertias, are obtained as an extension of the Mindlin-McNiven theory to the case of nonuniform rods. Responses of both the semi-infinite rod and finite rod with elastic end support due to either a step or a pulse loading are studied by the method of characteristics. Calculated results such as stresses versus time for different stations along the rod and stresses as functions of distance for instants of time are presented and compared for several cases. The geometrical effect of the variation of section on the stresses and velocities and the effect of the elastic support on the reflection and propagation of the stress waves are deduced. Author (GRA)

N72-16922# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSIDERATION OF WEIGHT IN DESIGNING STRUCTURES UNDER CREEP CONDITIONS
Yu. V. Nemirovskii 16 Aug. 1971 26 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (Moscow), no. 4, 1970 p 113-123
(Contract F33657-71-D-0057; AF Proj. 1368)
(AD-732274; FTD-HC-23-731-71) Avail: NTIS CSCL 13/13

In recent years, many new general results have been obtained in the theory of optimum design of elastic and plastic structures. The present paper is an attempt to use optimum methods for designing minimum weight structures under creep conditions. Author (GRA)

N72-16923# Wisconsin Univ., Madison. Mathematics Research Center.
BUCKLING OF A CIRCULAR PLATE IMBEDDED IN A NONLINEAR ELASTIC FOUNDATION
H. Steinberg Jul. 1971 38 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-732047; MRC-TSR-1064) Avail: NTIS CSCL 20/11

The buckling of a circular plate subjected to a uniformly distributed compressive edge loading while imbedded in a non-linear elastic foundation is studied. Particular attention is given to the character of solutions in the neighborhood of the points of bifurcation. A perturbation procedure is used to determine the manner in which the buckled solutions depend upon the properties of the foundation. Author (GRA)

N72-16924# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Forest Products.
SOME ASPECTS OF STRESS FIELDS AT SHARP NOTCHES IN ORTHOTROPIC MATERIALS. 1: PLANE STRESS
R. H. Leicester 1971 17 p refs
(PB-201933; TP-57) Avail: NTIS CSCL 20K

A method is presented for the analysis of the stress field at the root of a mathematically sharp notch of arbitrary notch angle. The application of this method indicates that in general there are two singularities of stress at the roots of notches in typical orthotropic structural materials. The magnitudes of these singularities are used as a basis for proposed definitions of stress intensity factors for notches of arbitrary notch angle. This study also includes some discussion on the measurement of stress intensity factors, on a stress function for the analysis of orthotropic bodies containing sharp cracks and on the range of elastic parameters of orthotropic structural materials.
Author (GRA)

N72-16925# Naval Civil Engineering Lab., Port Hueneme, Calif.
USE OF AN AERODYNAMIC OBSTRUCTION TO SHIELD A BLAST DOOR: RESULTS OF AN EXPERIMENTAL MODEL TEST Final Report, Jun. 1970 - Apr. 1971
J. M. Ferritto Oct. 1971 34 p refs
(YF Proj. 38-534-001-01-011)
(AD-732362; NCEL-TR-739) Avail: NTIS CSCL 13/13

Triangular prismatic aerodynamic obstructions can be used to shield a blast door. The objectives of this project were to evaluate the protection afforded by an obstruction and to determine the relative width of obstruction required to protect a given width of entrance. A study was performed from which similitude relationships were developed. A series of tests was conducted in which a protected and an unprotected model structure were subjected to blast waves from explosive charges. A 45-degree triangular prismatic obstruction was used to shield the protected structure. Fifteen variations of width and position of obstruction were evaluated. Results show that at the 100-psi overpressure level an obstruction 1 door-height high and 2 door-widths wide placed from 1 to 2 door-heights away from a structure can reduce the peak reflected pressure by 50%.
Author (GRA)

N72-16926# Army Foreign Science and Technology Center, Charlottesville, Va.
TORSION OF AN ELASTIC HALFSPACE, WEAKENED BY A PLANE CIRCULAR CRACK
V. S. Protsenko 27 Sep. 1971 12 p refs Transl. into ENGLISH from Inzh. Zh., Mekh. Tverd. Tela (Moscow), no. 6, 1969 p 67-71
(AD-731872; FSTC-HT-23-610-71) Avail: NTIS CSCL 20/11

An axisymmetric case of torsion by a flat, round punch on an elastic halfspace, weakened by a circular crack, is considered. It is assumed that the crack is free of loading. The influence of the crack on the distribution of tangent stresses along the punch is investigated, and also the matter of tangent stress concentration with approach to the edges of the crack. The problem is solved by a method of integral equation pairs. Author (GRA)

N72-16927# Wisconsin Univ., Madison. Mathematics Research Center.
A SURVEY OF PLASTIC BUCKLING
M. J. Sewell Aug. 1971 179 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-732053; MRC-TSR-1137) Avail: NTIS CSCL 20/11

An elementary up-to-date account is given of the basic features of buckling in perfect and imperfect plastic columns. A self-contained general theory of bifurcation and stability in arbitrarily shaped elastic/plastic and rigid/plastic bodies is described, with comment on applications. A bibliography of over 600 papers pertaining to plastic buckling is given, most of them describing work done during the past fifteen years.
Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-16928# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
UNIFIED THEORY FOR THE BENDING AND BUCKLING OF SANDWICH SHELLS APPLICATION TO AXIALLY COMPRESSED, CIRCULAR CYLINDER SHELLS Final Technical Report
Geert Bartelds and Jean Mayers Jul. 1971 121 p refs
(Contract DA-44-177-AMC-155(T); Task-1F1-62204-A-17002)
(AD-731748; SUDAAR-287; USAAVLABS-TR-69-83) Avail: NTIS CSCL 20/11

A variational development of the governing equations and boundary conditions for the bending and buckling of sandwich curved plates and shells is presented. The theory is applicable to sandwich construction of the honeycomb type and may be used to describe bending, buckling, and postbuckling behavior. With the coupled effects of core transverse shear and normal strain included, the theory reflects the presence of 8 degrees of freedom and 2 constraining conditions. Nine boundary conditions per curved plate or shell edge can be specified; apart from the four of the usual type for each of the sandwich facing elements, in terms of either a generalized force or displacement, a condition for either the shear loading or the average displacement of the core is obtained. The governing equations, specialized for small-displacement buckling, are applied to the case of axial compression of circular cylindrical shells. The unified theory analysis reflects three modes of buckling: classical general instability and both symmetric and antisymmetric wrinkling.
Author (GRA)

N72-16929# North Carolina State Univ., Raleigh. Dept. of Mathematics.
STRESS BOUNDARY-VALUE PROBLEMS FOR INFINITE WEDGES Interim Report
W. J. Harrington and T. W. Ting (Ill. Univ., Urbana) Sep. 1971 18 p refs Repr. from J. of Elasticity (Netherlands), v. 1, Sep. 1971 p 65-81
(Grant AF-AFOSR-1779-69; AF Proj. 9749)
(AD-732270; AFOSR-71-2847TR) Avail: NTIS CSCL 20/11

A stress boundary-value problem for infinite wedges is formulated by imposing a certain regularity requirement at infinity and at the vertex. It is then solved with complete rigor by means of Mellin transforms and the necessity of the regularity condition to assure the uniqueness of solution is further explored. By establishing the existence as well as the rate of its complex inversion integral, a numerical scheme has been proposed and numerical examples have been worked out as illustrations.
Author (GRA)

N72-16930# Brown Univ., Providence, R.I. Div. of Engineering.
SUDDEN EXTENSION OF A CRACK IN AN ELASTIC SOLID Summary Report, Mar. - Jun. 1971
L. B. Freund Aug. 1971 34 p refs
(Contract F33615-71-C-1308; Task-735303)
(AD-732269; AFML-TR-71-176) Avail: NTIS CSCL 20/11

A particular motion of a half plane crack in an elastic solid subjected to general loading is considered. The loading is prescribed so that the mode of deformation of the crack is the plane strain opening mode. The crack is initially at rest and then, at a certain instant, begins to move with a constant velocity which is less than the Rayleigh wave speed. A fundamental solution is derived for particular loading on the body which makes it possible to obtain the solution for the complete dynamic stress field due to crack extension by linear superposition. The details of the solution are worked out for the dynamic stress intensity factor for the moving crack. It is found that the stress intensity factor varies almost linearly with crack speed, from the static value at zero speed to zero at the Rayleigh wave speed. Some numerical results are also presented for the shape of the crack tip as a function of crack speed. Finally, the energy release rate of the moving crack tip is plotted as a function of crack tip speed.
Author (GRA)

N72-16931 Stevens Inst. of Tech., Hoboken, N.J.
FLAME SPREADING OVER SOLID FUEL BEDS: SOLID AND GAS PHASE ENERGY CONSIDERATIONS Ph.D. Thesis
Frank Anthony Lastrina 1970 122 p
Avail: Univ. Microfilms Order No. 71-1174

An analytical and experimental investigation of flame spread over the surface of a solid fuel bed in an oxygen-inert environment is reported. The flame velocity is found to depend upon the ignition region length and the total heat flux into the surface from the ignition region of the flame; and both of these variables are functions of gas-phase parameters. The results from the gas-phase analysis combined with the solutions to the solid-phase energy equation yield relationships between flame spreading velocity and parameters of theoretical and practical interest for both thin and thick fuel beds.
Dissert. Abstr.

N72-16932 Ohio State Univ., Columbus.
AN INVESTIGATION OF OVER-DRIVEN DETONATION WAVES AND THE IGNITION OF COMBUSTIBLE GASEOUS MIXTURES BY STRONG SHOCK WAVES Ph.D. Thesis
John S. Vamos 1970 183 p
Avail: Univ. Microfilms Order No. 70-26376

Experiments were conducted to determine (1) the reactions behind shock waves in combustible mixtures which were strong enough to produce in most instances over-driven detonation waves, (2) the structure of such waves, and (3) the ignition delay times. A shock tube was employed in the investigation. The wave structure was examined with the help of spark schlieren photographs. Over-driven detonation waves in lean hydrogen-oxygen mixtures were found to contain transverse waves behind the front in above limit, limit, or below limt mixtures. The spacing between transverse waves was found to be inversely proportional to the wave speed. Ignition delay times measured behind reflected normal shock waves in hydrogen-nitric oxide mixtures were found to be much longer than in hydrogen-oxgen mixtures. Failure to achieve detonations in the hydrogen-nitric oxide mixtures may be explained by the long ignition delay times.
Dissert. Abstr.

N72-16933*# Vought Missiles and Space Co., Dallas, Tex.
EVALUATION AND SELECTION OF REFRIGERATION SYSTEMS FOR LUNAR SURFACE AND SPACE APPLICATIONS
R. J. Copeland, T. D. Blount, and J. L. Williams 31 Oct. 1971 233 p refs
(Contract NAS9-9912)
(NASA-CR-115352; T-122RP04) Avail: NTIS CSCL 20M

Evaluated are the various refrigeration machines which could be used to provide heat rejection in environmental control systems for lunar surface and spacecraft applications, in order to select the best refrigeration machine for satisfying each individual application and the best refrigeration machine for satisfying all of the applications. The refrigeration machine considered include: (1) vapor comparison cycle (work-driven); (2) vapor adsorption cycle (heat-driven); (3) vapor absorption cycle (heat-driven); (4) thermoelectric (electrically-driven); (5) gas cycle (work driven); (6) steam-jet (heat-driven).
Author

N72-16934# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
EFFECTIVE STACK HEIGHTS FOR TALL STACKS

Jeffery C. Weil and David P. Hoult Oct. 1971 46 p refs
(F03-AP-41-1105-02)
(FML-Publ-71-14) Avail: NTIS

A simple method is given to predict the effective stack height for a tall stack and the corresponding ground-level concentrations of the effluents emitted from the stack. The height of the convective mixing region of the atmosphere determines when the effluents are carried to the ground in downward moving air currents. A model to determine the scale of the mixing region is presented and verified with vertical temperature profile measurements. Previous theories on buoyant plume rise are used to determine the effective stack height. For a plume rising in a stable atmosphere the levelled-off height of the plume is shown to be the effective stack height. In a neutral atmosphere the effective stack height is given by the height where the plume rise velocity is equal to the vertical velocity scale in the mixing layer. A total of 760 measurements of the axial ground-level concentration of sulfur dioxide downwind of a 244 m stack are empirically correlated. Author

N72-16935*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FABRICATION AND EVALUATION OF CHEMICALLY VAPOR DEPOSITED TUNGSTEN HEAT PIPE
Robert J. Bacigalupi 1972 8 p refs Proposed for presentation at 3d Intern. Conf. on Chem. Vapor Disposition, Salt Lake City, 24-27 Apr. 1972, sponsored by Am. Nucl. Soc.
(NASA-TM-X-67987; E-6723) Avail: NTIS CSCL 20M

A network of lithium-filled tungsten heat pipes is considered as a method of heat extraction from high temperature nuclear reactors. The need for material purity and shape versatility in these applications dictates the use of chemically vapor deposited (CVD) tungsten. Adaptability of CVD tungsten to complex heat pipe designs is shown. Deposition and welding techniques are described. Operation of two lithium-filled CVD tungsten heat pipes above 1800 K is discussed. Author

N72-16936*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT-GAS-SIDE HEAT TRANSFER WITH AND WITHOUT FILM COOLING ON A SIMULATED NUCLEAR ROCKET THRUST CHAMBER USING H2-O2
Richard J. Quentmeyer, Ralph L. Schacht, and William L. Jones Washington Feb. 1972 38 p refs
(NASA-TN-D-6638; E-6553) Avail: NTIS CSCL 20M

Heat-transfer coefficients were obtained on a thrust chamber which simulated the geometry of the NERVA nuclear rocket. The tests were performed with and without peripheral film cooling over a chamber pressure range of 1.05 million to 5.84 million newtons per square meter (153 to 847 psia). With no film cooling, the overall axial variation in the value of the correlation coefficient C of the equation (Stanton)* (Prandtl)* to the 0.7ths power = C(Reynolds)* to the -0.2ths power, where * indicates the reference enthalpy condition, was reduced 66 percent when the local diameter in the Reynolds number was replaced by the axial distance from the injector face. The average peak values of C were reduced 25 percent with 2 and 3.75 percent cooling and 50 percent with 7.5 percent cooling. Author

N72-16937*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A SMALL ANNULAR TURBOJET COMBUSTOR DESIGNED FOR LOW COST
James S. Fear Washington Feb. 1972 40 p refs
(NASA-TM-X-2476; E-6320) Avail: NTIS CSCL 20M

Performance investigations were conducted on a combustor utilizing several cost-reducing innovations and designed for use in a low-cost 4448-N thrust turbojet engine for commercial light aircraft. Low-cost features included simple, air-atomizing fuel injectors; combustor liners of perforated sheet; and the use of inexpensive type 304 stainless-steel material. Combustion efficiencies at the cruise and sea-level-takeoff design points were approximately 97 and 98 percent, respectively. The combustor isothermal pressure loss was 6.3 percent at the cruise-condition diffuser inlet Mach number of 0.34. The combustor exit temperature pattern factor was less than 0.24 at both the cruise and sea-level-takeoff design points. The combustor exit average radial temperature profiles at all conditions were in very good agreement with the design profile. Author

N72-16938# Grumman Aerospace Corp., Bethpage, N.Y.
RADIATION HEAT TRANSFER IN CERAMIC REENTRY HEAT SHIELDS
J. Reichman Jan. 1972 37 p refs To be presented at the 74th Ann. Meeting of the Am. Ceramic Soc., Washington, D.C., 6-11 May 1972
(RE-419J) Avail: NTIS

The material parameters commonly used, those of emissivity and the radiative component of thermal conductivity, are examined to determine their validity in characterizing the heat transfer processes in a radiative reentry heat shield. This is done by comparing calculations of radiative heat fluxes and temperature distributions of two models. The first one uses the standard heat conduction equation employing the above parameters, while the second is based on more exact radiative transfer theory that uses the radiation parameters of absorption and scattering coefficients. Results of these calculations indicate that for typical aerodynamic heat fluxes calculated temperature distributions for the two models varied significantly, particularly near the surface. The standard model in general gives surface temperatures and gradients considerably lower than those of the more exact model. It is also found that the radiant emission cannot be determined from the emissivity and surface temperature but rather that it is a function of the temperature distribution in the material. This is because of the partial transparency of the ceramic, making emission a volume rather than a surface phenomenon. Numerical results indicate that improved performance results as the absorption coefficient gets larger. Author

N72-16939# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
PHENOMENOLOGICAL WEAK SCALING THEORY (PRELIMINARY VERSION)
W. K. Theumann Oct. 1971 25 p refs
(LPTHE-71/51) Avail: NTIS

The thermodynamic behavior of an Ising model near the critical point was determined from phenomenological arguments for the case when the spin-spin correlation function departs from the usual (strong) scaling form. This was achieved by means of a weak scaling scheme based on a single effective correlation length which depends on a new critical exponent omega. A specific homogeneous form was found for the equation of state and explicit expressions for the exponents alpha, beta, delta, epsilon and Delta (2n) in terms of omega, which imply certain dimensionality dependent inequalities between critical exponents. A single value of omega enough to yield exponents which are in agreement with numerical estimates on the three-dimensional Ising model and with mean field theory for d greater than or equal to 4. Departure from strong scaling may be expected for general pair correlations, and it is shown that the weak scaling scheme connects weak scaling energy density - energy density correlations with inequalities involving the corresponding critical exponents. Author

N72-16940# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
AN EXPERIMENTAL CRITIQUE TO THE THERMAL NODAL ANALYSIS
Koichi Oshima Oct. 1971 56 p refs
(ISAS-468-Vol-36-10) Avail: NTIS

Measured temperature data on the space simulation test of a thermal model of a spacecraft were treated using the least square estimation and the regression analysis. The errors between the measured temperature and the estimated one were analysed statistically. Based on this study, a standard procedure

to determine the thermal nodal network parameters from the space simulation test data was established. Moreover, the best mathematical model of the nodal network system to estimate the nodal temperature with the highest accuracy was chosen out of many possible network models. It is shown that the outer-hull-and-inner-canister model with moderate number of the canister nodes is the best model. Also it is note-worthy that the best model is not the one with the largest node numbers.
Author

N72-16941# Argonne National Lab., Ill. Engineering and Technology Div.
ENGINEERING RELATIONSHIPS FOR TURBULENT FORCED CONVECTION HEAT TRANSFER IN DUCTS WITH FLUX TRANSIENTS
Ralph P. Stein Jun. 1971 31 p refs
(Contract W-31-109-eng-38)
(ANL-7754; DR-1913) Avail: NTIS

Engineering relationships to account for turbulent forced-convection heat transfer in ducts during heat-flux transients and steady flow are derived. These relationships are suggested as more accurate replacements for the simple heat-transfer-coefficient expression currently used in most engineering computations involving transients. The new relationships have a form where the dimensionless coefficients depend on Reynolds and Prandtl numbers and on duct shape. Tabulated values of these coefficients for the circular tube, parallel-plane duct, and pin bundle are given for wide ranges of Reynolds and Prandtl numbers, with emphasis on liquid metals. Author (NSA)

N72-16942# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
CONVECTIVE HEAT TRANSFER IN LONGITUDINAL FLOW THROUGH TUBES AND ROD BUNDLES
G. Markoczy Apr. 1971 154 p refs In GERMAN
(EIR-198) Avail: AEC Depository Libraries

Convective heat transfer in tubes and rod bundles was theoretically and experimentally studied under forced axial turbulent flow. It was shown that heat transfer coefficients under these complex conditions could not be determined by means of geometry-dependent correction functions. Therefore, new relationships were developed which described with sufficient accuracy local heat transfer in bundles of various arrangements. Two mathematical procedures were developed and tested on 2000 experimental measurements. The first one is an involved analytical procedure, while the second is simple and semi-empirical. Author (NSA)

N72-16943# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energetischeskii Inst.
CRISIS OF HEAT TRANSFER IN PIPES
B. A. Zenkevich, O. L. Peskov, and A. P. Sapankevich 1970 35 p refs In RUSSIAN
(FEI-217) Avail: AEC Depository Libraries

Experiments were performed to study the effects on the heat transfer crisis of film and diffusion components in two-phase flow in the dispersion-annular flow regime. Experimental data obtained in uniformly heated tubes and in tubes with axial cosinusoidal distribution of the heat flow are presented. Analysis of experimental data under other axial distributions of the heat flow showed the presence of feedback between the local critical heat flow and the local rate of flow of the liquid to the cross section of the crisis. The coefficients of mass transfer by influx were analyzed and used to calculate recommended local critical thermal flows in pipes. NSA

N72-16944# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
ANALYSIS OF FLOW STABILITY IN BOILING SYSTEMS WITH THE TOSCLE CODE
N. Spinks May 1971 30 p refs
(AAEC/E-217) Avail: AEC Depositories Libraries

Two-phase-flow stability can be analyzed with the TOSCLE code. TOSCLE uses equations derived by linearizing and taking Laplace transformations of the mass, energy and momentum conservation equations and solving the resultant one space dimension equations analytically along a straight, uniform cross section pipe with uniform heat addition or removal per unit length. Separate solutions are obtained for single-phase regions and two-phase regions of the pipe. The code calculates steady state pressure drop for given inlet velocity, then perturbed pressure drop for given inlet velocity perturbation. The latter calculation is repeated at a number of frequencies to permit the drawing of a Nyquist plot of the inlet velocity to pressure drop transfer function from which stability is assessed. A simple slip correlation is incorporated as well as a two-phase-friction multiplier, which is taken as a quadratic in quality. Author

N72-16945# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Reaktortechnik.
INVESTIGATIONS OF THE DYNAMICS OF HEAT TRANSFER. PART 2: MODEL OF AXIAL HEAT TRANSFER IN TURBULENT TUBE FLOW
H. Schmidl Mar. 1971 109 p refs In GERMAN
(SGAE-RT-38/1971-Pt-2; Work-Rept-5) Avail: AEC Depository Libraries

The dynamic behavior of a heat transfer medium is difficult to determine. Therefore, in order to facilitate a solution to the problem a selected tube flow was treated with only two dimensions. The principles of heat transfer in turbulent flow of an incompressible medium were determined. A model for axial heat transfer with turbulent tube flow was derived. NSA

N72-16946# Los Alamos Scientific Lab., N.Mex.
THERMODYNAMIC PROPERTIES OF PuRu2 FROM EMF MEASUREMENTS
George M. Campbell Sep. 1971 4 p refs
(Contract W-7405-eng-36)
(LA-4758) Avail: NTIS

Nonstationary emf techniques were used to ensure reversibility and singularity of electrode ractions in the emf cell Pu(l)/PuCl3, LiCl-KCl/PuRu2 + Ru(s) at temperatures between 913 and 1078 K. The free energy of formation of PuRu2 at 1000 K was found to be Delta G sub f1000 = -8.08 + 0.0013 T kcal/mole. Thermodynamic properties were estimated at lower temperatures. Author (NSA)

N72-16947# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
A STUDY OF THE EFFECTS OF ELECTRIC FIELDS ON SOLID PROPELLANT BURNING RATES Technical Report, Oct. 1968 - Jun. 1970
Robert F. Bestgen Jul. 1971 179 p refs
(AF Proj. 305901-ATB)
(AD-731840; AFRPL-TR-71-87) Avail: NTIS CSCL 21/2

An experimental study, guided by theoretical considerations, was made on the effects of electric fields on burning rate of two metallized composite propellants. Mechanisms causing observed burning rate changes were sought. Experimental data include flame electron number densities, electrical conductivities, electric field strengths, electric currents, combustion efficiencies, exhaust emissions spectra and continuous measurement of burning rates. Results show that burning rate increases are due to current heating of the nonburning propellant and that burning rate decreases involve flame electrons, causing inhibited combustion under proper voltage conditions. Non-collective reactional interference was inferred for this latter case. Author (GRA)

N72-16948# Aerotherm Corp., Mountain View, Calif.
BASELINE SOLUTIONS FOR THE SMOOTH WALL THERMOCHEMICAL ABLATION RESPONSE OF GRAPHITE AND CARBON PHENOLIC Final report, 1 Mar. - 30 Oct. 1970
R. A. Rindal, M. R. Wool, and C. A. Powars Wright-Patterson

AFB, Ohio AFML Jul. 1971 69 p refs
(Contract F33615-69-C-1626; Task-738102)
(AD-731813; Aerotherm-70-21; AFML-TR-71-74) Avail: NTIS CSCL 20/3

Recently acquired high pressure ablation data for graphite and carbon phenolic are analyzed with the objective of establishing the magnitude of discrepancies between measured ablation rates and smooth-wall thermochemical only predictions. Data were obtained and are believed of sufficient quality to reach meaningful conclusions with respect to the magnitude of ablation enhancement resulting from the combined effects of rough-wall and mechanical erosion phenomena. Comparisons between predicted and measured recession are presented for laminar and turbulent conditions for models tested in the Cornell Wave Superheater, the AFFDL 50 MW arc-jet, and the AEDC ballistic range. The ratio of predicted-to-measured recession for laminar and turbulent flow for both materials correlate moderately well with local pressure. Author (GRA)

N72-16949# Sheffield Univ. (England). Dept. of Chemical Engineering and Fuel Technology.
MIXING AND COMBUSTION OF HYDROGEN IN A SUPERSONIC AIRSTREAM Ph.D. Thesis
Malcolm Thomas Jacques Feb. 1971 207 p refs
(Grant EOOAR-0071-70; AF Proj. 9711)
(AD-731239; HIC-170; AFOSR-71-2636TR) Avail: NTIS CSCL 21/2

The report is concerned with the mixing and combustion of hydrogen in a high enthalpy Mach 3.5 airstream, in which the conditions are such that the combustion process is mixing limited. The high enthalpy conditions are obtained using a combustion driven hypersonic shock tunnel. A gas composition probe having a response time of 0.25 msec. has been constructed and used in contamination and combustion studies. Combustion results have been obtained from a 2-D Mach 3.5 test section using both a mid-stream vortex generating injector and a plain wedge injector. The turbulent mixing characteristics of the two wakes were determined using a semi-quantitative approach which utilizes well established relationships of structural turbulence theory. The results of this analysis showed the importance of the initial turbulence generation on the overall mixing process.
Author (GRA)

N72-16950# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
TRANSIENT STRESSES DUE TO HEATING OF A PLANE BOUNDARY
A. Jahanshahi Nov. 1971 37 p refs
(Contract N00014-67-A-0077-0009; NR Proj. 064-401)
(AD-732052; TR-8) Avail: NTIS CSCL 20/11

The solution to the problem of plane state of strain in a semi-infinite isotropic elastic medium subjected to an instantaneous line heat source at the boundary is obtained in closed form, in terms of tabulated functions. This solution is regarded as fundamental and is employed to derive solutions to transient thermal stress fields for several cases of boundary heating of practical interest. Closed form nature of the solutions are given, permitting detailed discussion of the fields.
Author (GRA)

N72-16951# Army Foreign Science and Technology Center, Charlottesville, Va.
SYSTEMATIC ERRORS IN THE DETERMINATION OF THE THERMAL CONDUCTIVITY OF METALS BY KOHLRAUSCH'S METHOD
E. N. Bezrukova and O. A. Sergeev 22 Sep. 1971 11 p refs
Transl. into ENGLISH from "Transactions of the All-Union Conference on Thermophysical Properties of Substances at High Temperatures, Novosibirsk, 25-30 July 1966"
(FSTC Proj. T7023012301)
(AD-732197; FSTC-HT-23-488-71) Avail: NTIS CSCL 20/13

Kohlrausch's method is one of the most accurate methods for determination of the thermal conductivity coefficient of metals. The theory of the method was established by Jager and Disselhorst. It permitted the creation of a method for taking into account the correction for heat exchange of the end surfaces of a thin metal rod subject to additional heating by electric current while in an oven. However, in theory the temperature dependence of the heat transfer coefficient and of the specific resistance are not considered. There is no derivation for the correction related to the non-uniformity of the temperature profile in the oven. It is the purpose of the present work to supplement the mentioned gaps in the theory. Author (GRA)

N72-16952# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
THE DOWNSTREAM EFFECTS OF TRANSPIRATION COOLING ON THE HEAT SHIELD OF A SLENDER NOSE CONE Technical Report, Feb. 1969 - Dec. 1970
John A. Marshall and S. Srinivasan Jun. 1971 74 p refs
(Task-734001)
(AD-731757; AFML-TR-71-46) Avail: NTIS CSCL 16/3

An experimental investigation was performed to determine the effects of steady state upstream transpiration cooling on the surface temperature of a carbon phenolic downstream heat shield of an eight-degree half-angle cone. The test model was exposed to gas stream stagnation temperatures of 5950R to 8460R, enthalpies up to 4340 Btu/lb, and to velocities up to Mach 10. It was demonstrated that a helium coolant flow rate of about .00036 lb/sec was sufficient to prevent model decomposition (charring) or ablation over a 100 second period. The heat losses from the temperature sensing devices (calorimeters) were estimated to be of the order of six to seven percent. Author (GRA)

N72-16953# Naval Scientific and Technical Intelligence Center, Washington, D.C. Translation Div.
EQUATION OF STATE AND HEAT CAPACITY OF WATER OVER A WIDE RANGE OF THERMODYNAMIC PARAMETERS
N. M. Kuznetsov 18 Oct. 1971 21 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 1, 1961 p 112-120
(AD-731464; NAVSTIC-Trans-3250) Avail: NTIS CSCL 20/13

The equation of state and heat capacity obtained from this work make it possible to determine the energy and pressure of water from its temperature and density over a wide range of thermodynamic parameters, with an error of 15-20%. The equation of state and heat capacity also determine, in parametric form (by means of the parameter T), relationships among the quantities (p, rho, E) which can be used in the solution of certain hydrodynamic problems. Author (GRA)

N72-16954# Space Sciences, Inc., Monrovia, Calif.
DETERMINATION OF THE THERMODYNAMIC PROPERTIES OF IONIZED SPECIES Final Report, 15 Jun. 1970 - 15 Jun. 1971
Milton Farbar, R. D. Srivastava, and O. M. Uy Jul. 1971 50 p refs
(Contract F04611-70-C-0041)
(AD-731303; AFRPL-TR-71-94) Avail: NTIS CSCL 07/4

The heat of formation and electron affinity for several negative ions which may be present in rocket exhausts have been determined. A molecular flow effusion-mass spectrometric technique was employed in obtaining these data for the following species: BO(-), BO2(-), BF2(-), BF4(-), BF2(-), BF2O, AlO(-), AlO2(-), AlF2(-), AlF4(-), AlF2O(-), AlF2O. Author (GRA)

N72-16955# Denver Research Inst., Colo. Mechanical Sciences and Environmental Engineering Div.
CALCULATION OF SELF-SUSPENDED FLARE TRAJECTORIES Final Report, 1 Jun. 1969 - 31 Dec. 1970
Harry Peterson 16 Sep. 1971 117 p refs
(Contract N00164-69-C-0216; DRI Proj. 4260)
(AD-731683; DRI-4260-7102-F; NAD-CR-RDTR-193) Avail:

NTIS CSCL 19/1

The report summarizes and describes the work accomplished on Contract N00164-69-C-0216 (D.R.I. Project 4260 - Digital Computer Simulation and Calculation of Trajectories of Self-Suspended Flares) during the period June 1, 1969 thru December 31, 1970. The work was divided into two phases: The study of the effects of aerodynamic coefficients, launch velocity and burning rate on flare trajectory, and the study of the effects of aerodynamic moments on the flare trajectory. The description and documentation of the computer programs for two dimensional trajectory, and three dimensional trajectory are presented in Appendix A of the report. Author (GRA)

N72-16825*# Martin Marietta Corp., Denver, Colo.
A DISCUSSION OF PYROTECHNIC SHOCK CRITERIA
M. B. McGrath *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 1-7 refs (See N72-16824 07-32)
(Contract NAS5-15208)
(NASA-CR-125449) Avail: NTIS; Director, Navy Publ. and Printing Serv. Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 19A

N72-16826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SUMMARY OF PYROTECHNIC SHOCK IN THE AEROSPACE INDUSTRY
W. P. Rader (Martin Marietta Corp., Denver) and William F. Bangs *In* Shock and Vibration Inform. Center The Shock and Vibration Bull. 41, part 5 Dec. 1970 p 9-15 refs (See N72-16824 07-32)
(NASA-TM-X-67492) Avail: NTIS; Director, Navy Publ. and Printing Service Office, Naval District of Washington, Bldg. 157-2, Washington Navy Yard, Washington, D. C. 20390; $15.00/set CSCL 19A

N72-16410*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE COMBUSTION PROCESS
W. R. Downs *In its* Conf. on Mater. for Improved Fire Safety 1971 p 3-7 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

N72-16411*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SPACECRAFT NONMETALLIC-MATERIALS FLAMMABILITY SELECTIONT CRITERIA AND REQUIREMENTS
C. J. Katsikas and J. H. Levine *In its* Conf. on Mater. for Improved Fire Safety 1971 p 9-21 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

N72-16412*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
DEVELOPMENT OF MATERIALS SCREENING TESTS FOR OXYGEN-ENRICHED ENVIRONMENTS
R. L. Johnston and D. L. Pippen *In its* Conf. on Mater. for Improved Fire Safety 1971 p 23-27 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

N72-16414*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY TESTS FOR APOLLO COMMAND MODULE AND LUNAR MODULE MOCKUP
R. W. Bricker, J. P. Crabb, and I. K. Spiker *In its* Conf. on Mater. for Improved Fire Safety 1971 p 43-54 ref (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

N72-16424*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE EFFECTS OF GRAVITY ON FLAMMABILITY
James P. Pearce, J. Howard Kimzey, and David L. Pippen *In its* Conf. on Mater. for Improved Fire Safety 1971 p 137 refs This rept. was not presented at the conf. (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

N72-16429*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FIRE EXTINGUISHMENT IN HYPOBARIC AND HYPERBARIC ENVIRONMENTS
J. Howard Kimzey *In its* Conf. on Mater. for Improved Fire Safety 1971 p 163-169 refs (See N72-16409 07-18)
Avail: NTIS; SOD $2.25 CSCL 20M

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-16956 Middle East Technical Univ., Ankara (Turkey).
SCIENCE: ITS MEANING AND METHOD
Cemal Yildirim 1971 313 p refs
(METU-Publ-21) Copyright. Avail: Issuing Activity

An introductory text for a nontechnical elective course on the scientific method is presented. Topics discussed include aspects of the concept of science and its relation to other studies, the concept of the scientific method, and fact-finding procedures. A glossary, and a general bibliography are included. F.O.S.

N72-16957# Committee on Science and Astronautics (U. S. House).
INTERNATIONAL SCIENCE POLICY Compilation of Conference Papers
Washington GPO Feb. 1971 162 p refs Papers presented at the 12th Meeting of the Panel on Sci. and Technol. with the Comm. on Sci. and Technol., Washington, D. C., 1971. Compilation presented to Congr., Feb. 1971
Avail: NTIS; SOD $0.75

Conference papers presented to the Committee on Science and Astronautics consider the utilization of science and technology to solve today's critical national and international problems. Global formulation of a science policy and international management and application of scientific research to stop environmental pollution, improve the economics of developing countries, enhance the benefits of technology and to curb its dangers are the main topics. For individual titles, see N72-16958 through N72-16969.

N72-16958# University Corp. for Atmospheric Research, Boulder, Colo.
INTERNATIONAL COOPERATION IN THE ENVIRONMENTAL SCIENCES
Walter Orr Roberts *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 11-33 refs (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

International cooperation in various environmental science disciplines is projected. Specific environmental control problems discussed encompass: global air pollution, water pollution, man's effects on urban climates, weather modifications, biome studies of ecological disturbances, degradation effects in biological and medical systems, and environmental law. G.G.

N72-16959# International Centre for Theoretical Physics, Trieste (Italy).
INTERNATIONAL COOPERATION IN THE PHYSICAL SCIENCES
Abdus Salam *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 35-49 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

The need for international collaboration is outlined in order to secure the optimal use of research in physical sciences and to use existing science for the benefit of developing humanity. The setting of a world science policy, the establishing of science foundations and world universities, and a strengthening of U.N. agencies dealing with sciences are all essential for scientific collaboration. G.G.

N72-16960# International Council of Scientific Unions, Rome (Italy).
NEW MECHANISMS FOR SCIENTIFIC COOPERATION IN THE FUTURE
Viktor A. Ambartsumian *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 51-60 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

Problems of international scientific cooperation between the different countries are diverse. The possibility and feasibility of a world information system is considered. The implementation of scientific, multilateral, and international cooperation is the aim of all scientific organizations in order to complement each other in the various fields of scientific research. G.G.

N72-16961# Cornell Univ., Ithaca, N.Y. Program on Science, Technology and Society.
SCIENCE, TECHNOLOGY, THE MILITARY AND ARMS CONTROL
Franklin A. Long *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 61-72 refs (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

Contributions of science and technology to the effective control of a burgeoning military technology are considered in order to explore alternatives to military systems and war; emphasized are the possibilities of arms control and disarmament along with peace-keeping programs for the maintenance of international stability. It is stated that concepts of relative risks need improvement to clarify technical threats and to further the dissemination of pertinent information on problems of military technology, military forces, and arms control possibilities. G.G.

N72-16962# Gulf and Western Precision Engineering Co., Manchester, Conn.
NATIONAL SCIENCE POLICY, PRELUDE TO GLOBAL COOPERATION
Emilio Q. Daddario *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 73-80 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

A new policy formulation is required that incorporates new approaches and mechanisms for broader scientific international cooperation. Science and scientist must be more responsive to the needs of society and develop a more multilateral approach to scientific cooperation. It is suggested that more developed nations formulate a unified policy that serves the goals of a specific community of nations which are then implemented by an International Science Policy Committee. The latter thus provides an important means for the exchange of information and directs aid policies of its individual members. G.G.

N72-16963# National Academy of Public Administration, Washington, D.C.
ADMINISTRATIVE REQUIREMENTS FOR ADVANCING INTERNATIONAL SCIENCE POLICY
James E. Webb *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 81-90 ref (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

Practical ways are considered through which an international science policy can be made effective. Advocated are forms of organization and administration and forms of policy evolution that bring the substance of scientific and technical projects into close working relationships with effective public management. An Academy of Public Administration is projected as a necessary interface between scientific knowledge, engineering knowhow, the community of scientists and technologists and the environment in which these forces do their work. G.G.

N72-16964# International Centre of Insect Physiology and Ecology, Nairobi (Kenya).
INTERNATIONAL COOPERATION IN THE SOCIAL AND LIFE SCIENCES
Thomas R. Odhiambo (Nairobi Univ.) *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 91-109 ref (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

The problems and new mechanisms of international scientific cooperation in the life sciences are considered from the point of view of the developing countries, and especially Africa. Science and technology are regarded as major factors in advancing developing countries. Mechanisms of international cooperation to achieve desirable social objectives are: printed materials, scientific seminars, wandering scholars, patenting and selling of knowhow, and especially concentrated research centers and universities where fundamental research is carried out with a definite practical goal sharply in focus. G.G.

N72-16965# Steering Committee on Science Policy (Canadian Senate), Ottawa.
THE LEGISLATIVE ROLE IN SCIENCE POLICY
Allister Grosart *In* Comm. on Sci. and Astronaut Intern. Sci. Policy Feb. 1971 p 111-121 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

The organization of an international Parliamentary Science Association is advocated that is able to make scientific and budgetary contributions to the problems of high seas and ocean floors, disarmament, satellites, population, food, and the transfer of scientific and technological resources from the affluent to the developing countries. G.G.

N72-16966# National Academy of Sciences-National Research Council, Washington, D.C.
SCIENCE, TECHNOLOGY AND THE DEVELOPING COUNTRIES
Harrison S. Brown *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 123-132 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

Rapid economic development of the poor countries is essential to prevent social unrest and the eruption of wars. Expanded transfer of capital from the rich countries to the poor is essential for accelerated development and requires adequate organizational structures and technically trained persons. A number of bilaterial programs with organizations in developing countries are aimed at strengthening their local scientific-technological problem-solving competence. The creation of an International Development Institute is projected that can accelerate the development processes. G.G.

N72-16967# Stockholm School of Economics (Sweden).
THE ROLE OF SCIENCE POLICY IN SOLVING SOCIAL PROBLEMS
Staffan Burenstam Linder *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 133-141 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

A science policy in a form which prevents social strain is required to prevent reactions against science and technology that may completely change the direction and position of our civilization. The problem of unbalanced progress in economic

growth built on the results of science and technology manifests itself in fear and defeatism, inability to adjust to the demands of new technology, new types of poverty caused by economic growth that leads to partial affluence, a scarcity of natural resources, and the uneven geographic spread of the benefits of modern science and technology. An international science policy is required to correct these unbalances and to solve the problems that the application of science has caused by adoption of a cautious, but well financed program of technological development. G.G.

N72-16968# Centre d'Etudes Marines Avancees, Marseilles (France).
INTERNATIONAL SCIENCE POLICY IN THE MARINE ENVIRONMENT
Jacques Yves Cousteau *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 143-148 (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

A program of action on an international basis is outlined to stop the environmental pollution of oceans and their decrease in populations and vitality. Required is a 20% increase of money allocations to the sciences of environmental pollution, education of the public consumer to influence the producer, and persuasion of polluters that profits can be made through increased business volumes that result from the fight against pollution. Since the biggest polluters are the nations with the highest income per capita, it is proposed that Japan, North America, Europe, and Russia get together to adopt a policy that will immediately bring down pollution by about 80 percent. G.G.

N72-16969# Harvard Univ., Cambridge, Mass.
POTENTIAL CONSEQUENCES OF EXPERIMENTATION WITH HUMAN EGGS
James D. Watson *In* Comm. on Sci. and Astronaut. Intern. Sci. Policy Feb. 1971 p 149-161 refs (See N72-16957 07-34)
Avail: NTIS; SOD $0.75

The genetic engineering method of cloning and the test tube growth of human eggs leading to the asexual production of human beings require international scientific and legislative cooperation. Effective legislative guidance is needed to protect work on human embryos since the need for more basic embryological facts is much more relevant to our self-interest than the projected threat of a few clonal men existing some decades ahead. G.G.

N72-16970# Loughborough Univ. of Technology (England). Dept. of Transport Technology
A COMBINED CONCPTUAL/DATA BASED METHODOLOGY FOR THE DETERMINATION OF UNIVERSITY DEPARTMENTAL ACADEMIC, SUPPORTING AND ADMINISTRATIVE STAFF AT AN INTERNATIONAL LEVEL OF APPLICATION
Keith Legg Oct. 1971 67 p refs
(TT-71-09) Avail: NTIS

A generalized methodology is presented for calculating university departmental academic, supporting, and administrative staff for various subject classifications and geographical regions. Emphasis is placed on flexibility to accommodate different types of programs and parametric data are presented to facilitate numerical assessment. The complete method is illustrated by application to a typical United Kingdom university. The work is primarily intended for interdepartmental distribution analysis, but it can also be used in aggregated form for overall university resource model analysis. Author

N72-16971# Joint Publications Research Service, Washington, D.C.
READINGS IN SOVIET CYBERNETICS AND SOCIOLOGY
19 Jan. 1972 71 p refs Transl. into ENGLISH from Voprosy Filosofii (USSR), no. 10, 1971 p 28-75
(JPRS-54972) Avail: NTIS

Papers are presented on sociological and economic aspects of the Soviet society and the individual, and on environmental pollution control. For individual titles, see N72-16972 through N72-16975.

N72-16972# Joint Publications Research Service, Washington, D.C.
THE CONTEMPORARY STAGE OF THE SCIENTIFIC AND TECHNICAL REVOLUTION AND SOCIAL PLANNING
Z. I. Faynberg *In its* Readings in Soviet Cybernetics and Sociology 19 Jan. 1972 p 1-15 refs (See N72-16971 07-34)
Avail: NTIS

The necessity of social planning in a socialist society and its specific problems are briefly analyzed. Social planning is also related to economic planning and the division between them is determined. The basic link of social planning, efficiency of creative labor, significance of material incentive, general growth of material well-being, social advancement and motivation of labor, shifts in the relationship between managers and laborers, economic planning of production and distribution of goods, and relations between an industrial enterprise and all aspects of the society are discussed. N.E.N.

N72-16973# Joint Publications Research Service, Washington, D.C.
THE RELATIONSHIP OF THE SOCIAL ORGANIZATION AND THE INDIVIDUAL IN CONDITIONS OF THE SCIENTIFIC AND TECHNICAL REVOLUTION: ON THE THEORETICAL BASES OF THE CONCEPTION OF ROGER GARAUDY
K. M. Kantor *In its* Readings in Soviet Cybernetics and Sociology 19 Jan. 1972 p 16-35 refs (See N72-16971 07-34)
Avail: NTIS

The effects of the scientific and technical revolution on contemporary capitalist societies are discussed, and the concepts of Garaudy are refuted. The problem of the contradiction between capital and the need for a free development of the individual, is described, and quotations from Marx and Engels are used to explain the 'contradictions in capitalistic society' and the acquisition of true liberty by individuals in communistic society. The weaknesses in Garaudy's belief that the scientific and technical revolution advances only the problem of creative individuality without any connection with rational organization of production are stated. It is also pointed out that Garaudy does not consider the increased dependence of modern science on production or the socially organized structure of modern science, and it is suggested that he holds to views which might be called a 'cybernetic-existentialist utopianism'. N.E.N.

N72-16974# Joint Publications Research Service, Washington, D.C.
PHILOSOPHICAL PROBLEMS OF THE CONTROL OF THE BIOSPHERE **c05**
M. N. Rutkevich and S. S. Shvarts *In its* Readings in Soviet Cybernetics and Sociology 19 Jan. 1972 p 36-53 refs (See N72-16971 07-34)
Avail: NTIS

Philosophical effects are briefly discussed of the transformation from a dialectic interaction between society and the biosphere into the control of the biosphere. Environmental pollution in the U.S.A., Japan, Western Europe, and the U.S.S.R. is criticized, along with both extreme pessimists and credulous optimists. The noosphere concept of Thayer and modifications by Soviet philosophers are discussed. It is felt that ecology must be used to control the biospheric development, and the functions of biogeocoenoses are described. N.E.N.

N72-16975# Joint Publications Research Service, Washington, D.C.
HUMAN SOCIETY AS A SPECIAL TYPE OF

ORGANIZATION
E. S. Markaryan *In its* Readings in Soviet Cybernetics and Sociology 19 Jan. 1972 p 54-70 refs (See N72-16971 07-34)
Avail: NTIS

The organization of the human society and its characteristics are discussed. Information characteristics of human society and the concept of culture are described. Adaptive systems and the role of cybernetics in understanding adaptivity are considered. It is suggested that the human society belongs to adaptive-adapting systems, differing from simple adaptive systems represented by various forms of biological life. This expresses the special active-adaptive nature of human activity and its transformative nature. The concept of activity is defined as directed activity of living systems, originating on the basis of their relation to the surrounding environment for the purpose of self-support. Human activity is further defined as socially directed activity of people regulated by the mechanisms of culture. N.E.N.

N72-16976# Committee on Science and Astronautics (U. S. House).
SPACE SHUTTLE - SKYLAB: MANNED SPACE FLIGHT IN THE 1970'S Status Report
James E. Wilson, Harold A. Gould, W. H. Boone, Joe DelRiego, Carl Swartz et al Washington GPO Jan. 1972 1013 p ref Presented to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., Jan. 1972
Avail: Subcomm. on NASA Oversight

Skylab program cost, performance and schedule are the focus of this status report. Currently Skylab is within costs projected for the fiscal year and performance and schedule milestones are being met. Problems have been encountered in procuring and intergrating a number of experiment packages in Skylab but indications are that no delays will be incurred. Author

N72-16977# Committee on Aeronautical and Space Sciences (U. S. Senate).
INTERNATIONAL COOPERATION IN OUTER SPACE: A SYMPOSIUM A study of international space activities
Eilene Galloway, ed. (Library of Congr.) Washington GPO 1971 737 p refs Presented by the Comm. on Aeron. and Space Sci. to the 92d Congr., 1st Sess., 9 Dec. 1971
(S-Doc-92-57) Avail: SOD $3.00

A survey of space science, space technology, and the practical uses for the benefit of mankind is made. Data cover governmental, individual agencies, nongovernmental, and international programs. The data is to serve as an update of information on international cooperation in outer space and as a basic research source for planning the accomplishment of future goals for space research and exploration. E.H.W.

N72-16978# Royal Aircraft Establishment, Farnborough (England).
PRINCIPLES OF LONG-TERM PLANNING OF SPACE ACTIVITIES
Jun. 1971 18 p refs Transl. into ENGLISH of "Bases para una Planificacion a Largo Plazo en Actividades Espaciales", Comision Nacl. de Invest. Espaciales, Argentina, report
(RAE-Lib-Trans-1568; BR-27732; UDC-629.19(82)) Avail: NTIS

Details of the chief aims for space research in the Argentine are given. Each of the main headings is then sub-divided into its chief components and the estimated cost of each main aim is given. The first appendix shows, in detail, how the CNIE can fit into these plans by promoting space activities and the construction of vehicles and suitable launching bases as well as in the training of suitable personnel and cooperation with similar organisations in other countries. In the second appendix the cost of vehicle launching is considered in respect of the benefits to be obtained and it is considered that the Argentine should have its own launching facilities in 8 to 10 years. Author

N72-16979# National Bureau of Standards, Washington, D.C. Office of International Relations.
METEOROLOGY AND STANDARDIZATION IN LESS DEVELOPED COUNTRIES: THE ROLE OF A NATIONAL CAPABILITY FOR INDUSTRIALIZING ECONOMIES
H. L. Mason and H. S. Peiser, eds. Dec. 1971 392 p refs Seminar held at Warrenton, Va., 1-4 Feb. 1971
(Contract PASA-TA(CE)-5-71; NBS Proj. 1560950)
(NBS-SP-359) Avail: SOD $5.00 as C 13.10:359

Papers and discussions are presented which were given at a seminar on how the NBS experience in metrology and standardization might be used most effectively for less developed countries in building up their own technological infrastructures. Problems faced by the less developed countries are reported by participants from South and Central America, Africa, Asia, and New Zealand. The papers were organized around the session titles: perspective; sociological, economic, and managerial enviornment in industrializing countries; making scientific and technological measurement meaningful; dissemination of information; promoting more effective use of science and technology; case histories; promoting economic strength and commercial equity; and guidance for NBS technological assistance effort. Author

N72-16980# International Atomic Energy Agency, Vienna (Austria).
INTERNATIONAL NUCLEAR INFORMATION SYSTEM. AN EXERCISE IN INTERNATIONAL CO-OPERATION AND A SERVICE TO NUCLEAR SCIENTISTS AND ENGINEERS
Charles W. Pelzer, Zhan Turkov, and John E. Noolston Jul. 1971 14 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6 Sep. 1971
(A/Conf-49/P-206; Conf-710901-437) Avail: AEC Depository Libraries

The International Nuclear Information System (INIS) describes and indexes information published in 36 countries and by 8 international organizations. The descriptions are distributed on computer magnetic tape, in an announcement bulletin and on microfiches. Users of the system can select information on specific subjects from the total file. Thus individual scientists and engineers can be provided with both recent and retrospective information from world-wide sources. The unique and distinctive feature of INIS is its decentralized operation, an approach never attempted before on an international scale. Input to the system is provided by the country or organization in which the information is first published, so the amount of work required of each participant is normally proportional to the scale of its nuclear program. Input is received by the IAEA in Vienna, where it is checked and processed by a computer and by documentalists and output files are distributed for exploitation in participating countries. Author (NSA)

N72-16981# RWE-Aktiegesellschaft, Essen (West Germany).
RESOURCES OF PRIMARY ENERGY
Heinrich Mandel 24 Feb. 1972 27 p refs Presented at 4th Intern. Conf. on The Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6 Sep. 1971
(A/Conf-49/P/359; Conf-710901-123) Avail: AEC Depository Libraries

The fossil fuels should be sufficient for about 460 years, the basic materials for nuclear fission even sufficing for 25,000 years. This consideration, however, leads to false conclusions. It is necessary to take into account the world's population growth as well as the increasing per capita consumption. The result is that the reserves of fossil fuels would be sufficient for some more years only towards the end of the 21st century, whereas nuclear fuels would suffice for about 300 years. This means that, on one hand, the world will be dependent upon nuclear fusion at long sight, but that, on the other hand, sufficient time will be left to develop it. Author (NSA)

N72-16982# United Nations, New York. Dept. of Economic and Social Affairs.
WORLD ENERGY REQUIREMENTS AND RESOURCES IN

THE YEAR 2000
Jul. 1971 21 p refs Presented at the 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(A/Conf-49/P-420; Conf-710901-439) Avail: AEC Depository Libraries

Existing long-term projections of energy demand at global and regional levels are reviewed. Long term factors influencing the demand for energy in countries in various stages of socio-economic development are assessed. Likely shifts in the demand for energy over the long term period in the light of various assumptions relating, among others to prospective economic growth rates, and to technological changes and innovations that may produce major shifts in the long term pattern of energy consumption are identified. Author (NSA)

N72-16983# United Nations, New York. Office for Science and Technology.
SCIENCE AND TECHNOLOGY STRATEGY OF THE UNITED NATIONS; THE ROLE OF NUCLEAR TECHNOLOGY
B. Chatel Jun. 1971 18 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, Switzerland, 6 Sep. 1971
(A/Conf-49/P-421; Conf-710901-375) Avail: AEC Depository Libraries

The main elements of the overall strategy of the United Nations are reviewed briefly and the place occupied by nuclear technology within these international plans is discussed. NSA

N72-16984# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ANALYSIS OF THE SAFETY PROBLEMS DUE TO FLUORINE AND FLUORINE COMPOUNDS
Robert Bittel and Bernadette Vaubert Jun. 1971 56 p refs In FRENCH
(CEA-Bib-200; EUR-4669) Avail: AEC Depository Libraries

A survey was made on the problems raised by the protection of man and his environment against the hazards due to the release of fluorine and fluorine compounds. The main points requiring further study were brought out: the biochemical origin of the toxicity, long term effects of chronic pollution, dose effect relationships, and the setting of limiting levels.
Author (NSA)

N72-16985# European Space Research Organization, Paris (France).
REPORT PRESENTED TO THE FOURTEENTH COSPAR MEETING
1 Mar. 1971 124 p refs Conf. held at Seattle, Jun. 1971 Original contains color illustrations
Avail: NTIS

A review of ESRO satellites for 1970 is given. The satellites in orbit or decayed such as ESRO-2/IRIS, ESRO-1/AURORAE and Boreas, and HEOS-1, are included, as well as those under development, such as HEOS-A2, TD-1, ESRO-4, COS-B, and GEOS. Results of the 1970 sounding rocket launchings are also given. ESRO

N72-16986# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
[ACTIVITIES OF THE DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT] Annual report, 1969 [DFVLR JAHRESBERICHT 1969]
Aug. 1970 426 p In GERMAN
Avail: NTIS HC $6.00/MF $0.95

The annual report of the German Research and Test Establishment for Aeronautics and Astronautics is presented. Activity reports of the member institutes are given in several fields including: fluid mechanics, flight mechanics and flight control, materials service and structural mechanics, propulsion systems, electronics, space physics, environmental simulation and flight medicine. ESRO

N72-16987# European Space Research and Technology Center, Noordwijk (Netherlands).
DEVELOPMENT AND IMPLEMENTATION OF PROJECT MANAGEMENT INFORMATION SYSTEMS (PMIS)
Hellmuth Gehriger 16 Jun. 1971 57 p Presented at the Intern. Expert Seminar on Pract. Appl. of Proj. Network Tech. (INTERNET), 1971
Avail: NTIS

Some aspects of integrating existing techniques and computer programs with the human being into existing company or institutional organization structures are examined. Such an effort was undertaken to provide a sound basis for a comprehensive and reliable project management information system. The role of the project controller in these systems is shown, and special problems such as double loyalty, matrix structures, lack in the employment market, lack of appreciation, and cost accounting are discussed. ESRO

N72-16988# European Space Research Organization, Paris (France).
[ACTIVITIES OF THE EUROPEAN SPACE RESEARCH ORGANISATION] Annual Report, 1970
24 Feb. 1972 161 p Original contains color illustrations
Avail: NTIS

Among the activities and programs described are the telecommunication and aeronautical satellite and post-Apollo programs, ESRO satellites under development, future sounding-rocket policy, administration, and future research activities. ESRO

N72-16989# Aerophysics Research Corp., Bellevue, Wash.
COMBAT OPTIMIZATION AND ANALYSIS: COAP. VOLUME 4: PARAMETER OPTIMIZATION SUBPROGRAM MANUAL Final Report, Sep. 1969 - Dec. 1970
D. S. Hague, R. T. Jones, and C. R. Glatt Wright-Patterson AFB, Ohio AFFDL Aug. 1971 186 p refs
(Contract F33615-70-C-1036; AF Proj. 1431)
(AD-731802; AFFDL-TR-71-52-Vol-4) Avail: NTIS CSCL 19/2

COAP is a program for the simulation and optimization of combative and cooperative two-vehicle flight paths. It includes single vehicle flight path problem capability as a subcase. Considerable emphasis is placed on the use of modern optimization. The program has the ability to perform trajectory optimization by the variational steepest-descent method including search for optimal initial conditions; search for optimal arc (stage) lengths; constraints defined at terminal point, intermediate corners (stage points), or along the path; and optimum parameter (design variable) values. The program can solve two system (vehicle) problems with or without reacting feedback from the second system (vehicle). Alternatively, the program may be used to apply the direct multivariable search approach to trajectory optimization. Point mass equations of motion for a two-vehicle system are incorporated in the COAP program. Motion takes place about a rotating oblate planet having up to four harmonics in its gravitational field, non-uniform atmosphere and winds. Combative logic is defined in terms of vehicle relative states. The logic defines feedback control on the basis of relative state. The COAP program may utilize variational optimization procedures to determine optimal open loop control against a reacting opponent employing feedback control defined by combat logic.
Author (GRA)

N72-16990# Office of the Chief of Research and Development (Army), Washington, D.C.
PROCEEDINGS OF THE 10TH ANNUAL UNITED STATES ARMY OPERATIONS RESEARCH SYMPOSIUM Interim Technical Report
Sep. 1971 579 p ref Conf. Held at Durham, N. C., 26-28 May 1971
(AD-731795) Avail: NTIS HC $6.00/MF $0.95 CSCL 12/2

A technical report is presented containing papers presented in person and by title at the Tenth Annual U.S. Army Operations Research Symposium. The basic theme of the symposium was 'The Next Decade' GRA

N72-16991# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A FORCE SURVIVAL MODEL FOR ANALYSIS OF STRATEGIC BOMBER BASING CONCEPTS IN THE PRELAUNCH SURVIVAL MODE M.S. Thesis
Douglas D. Cochard and Robert E. Riggs Sep. 1971 140 p refs
(AD-732193; GSM/SM/71-3) Avail: NTIS CSCL 15/7

The prelaunch survival of strategic bombers will continue to be an important problem as long as they are to remain a viable part of the deterrent triad for the United States. Improving enemy technology and changing enemy strategies call for continued analysis of the problem. This study examines the parameters which govern prelaunch survival of strategic bombers. A model is developed to allow computation of total bomber force survival given the values for the necessary parameters. Several basing concepts and other means of improving force survival are analyzed with the aid of the model. Cost effectiveness analysis of the concepts discussed should be accomplished, and the results compared to other possible means of improving survival, e.g., ABM systems, before conclusions are made from the results of this study. Author (GRA)

N72-16992# Office of the Secretary of Transportation, Washington, D.C. Office of Noise Abatement.
CONFERENCE ON AIRCRAFT AND THE ENVIRONMENT, PART 2
Jun. 1971 24 p refs Conf. held at Wash., D.C., 8-10 Feb. 1971
(Contract DOT-OS-10025)
(PB-202038; OST-ONA-71-3-Pt-2) Avail: NTIS CSCL 13B

The proceedings of a conference on the air and noise pollution aspects of aircraft operation are presented. Subjects discussed are: (1) aircraft and airports as sources of pollution, (2) legal aspects of aircraft noise and sonic booms, (3) regulation of pollutant emissions from aircraft exhaust, (4) planning for compatibility of aircraft and environment, and (5) airport planning for environmental quality. P.N.F.

N72-16993# RAND Corp., Santa Monica, Calif.
USE OF WEATHER INFORMATION IN DETERMINING COST/PERFORMANCE AND FORCE-MIX TRADEOFFS: WEATHER AND WARPLANES, 1
R. E. Huschke Jun. 1971 50 p refs
(Contract F44620-67-C-0045)
(AD-731749; R-740-PR) Avail: NTIS CSCL 15/7

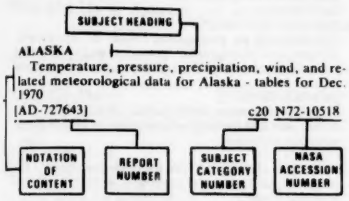
The report presents a selective overview of weather-effect studies over the past 20 years, and proposed methods for incorporating weather factors into the force planning and acquisition process. So-called all-weather systems have higher cost and, often, lower effectiveness than simpler systems, and may be stopped by sufficiently bad weather. Force deployment decisions could be tailored to the operational environment, if the weather sensitivities of systems and subsystems were realistically tested at the various stages of development, and sufficient research were done to enable these sensitivities to be translated into gross weather and climate parameters. Military aircraft are tested in nearly perfect weather, while nearly every type of weather in the world can be found somewhere in the U.S. Appendixes, coauthored respectively by C5 Schutz and R. R. Rapp, document the need for weather sensitivity tests, and present a preliminary mathematical model for including weather factors in force planning. Author (GRA)

N72-16994# Southwest Research Inst., San Antonio, Tex.
AUTOMATIC FIRE PROTECTION SYSTEM FOR MANNED HYPERBARIC CHAMBERS. PHASE 2: PROTOTYPE DESIGN, FABRICATION AND TEST. VOLUME B: OPERATORS MANUAL Final Report, 1 Jul. 1969 - 15 Jan. 1971
Lester A. Eggleston and William R. Herrera Jan. 1971 13 p
(Contract N62399-69-C-0045; YF Proj. 38.534.014.01.001; SWRI Proj. 03-2641)
(AD-731681; NCEL-CR-71.006-Vol-B) Avail: NTIS CSCL 13/12

A fire protection system for a hyperbaric chamber is briefly described. The major components of the fire protection system are two infrared detectors, one ionized particle detector, a water delivery system consisting of sprinkler nozzles and a hand line, and a control panel. The number of detectors which must sense a fire before activation of the water delivery system is variable. Procedures are described for setting the system in service and for maintaining it. Safety precautions are also included. Author (GRA)

N72-16030*# National Aeronautics and Space Administration, Washington, D.C.
AN OVERVIEW OF THE NASA POST-APOLLO PROGRAM
B. Bernier *In* ESRO Space Biology Related to the Post-Apollo Programme Aug. 1971 p 7-56 (See N72-16029 07-05)
(NASA-TM-X-67497) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

TYPICAL SUBJECT INDEX LISTING



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[JINR-P13-5896] c14 N72-16299
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[JINR-P13-5780] c14 N72-16300
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[JINR-P13-5838] c14 N72-16301
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[NASA-CR-61366] c15 N72-16331
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[NASA-TN-D-6628] c01 N72-15945
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[NASA-CASE-XGS-10010] c03 N72-15986
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[NASA-TN-D-6653] c15 N72-16335
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[AD-732341] c15 N72-16356
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PHOTOGRAPHIC PROCESSING EQUIPMENT
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[MATT-782] c16 N72-16362
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[KHFTI 70-62] c25 N72-16619
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[KHFTI-70/55] c25 N72-16617
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[KHFTI-70/54] c25 N72-16618
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[CEA-CONF-1804] c25 N72-16621
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[NP-19012] c25 N72-16633
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[NASA-CR-115357] c01 N72-15941
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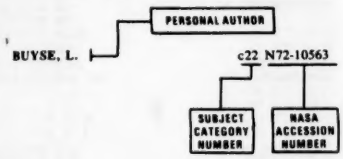

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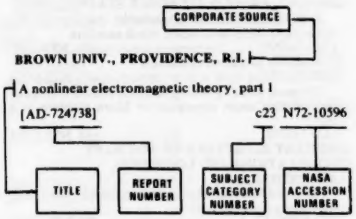

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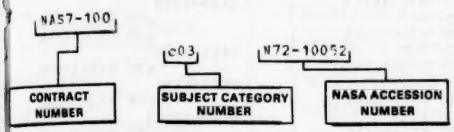

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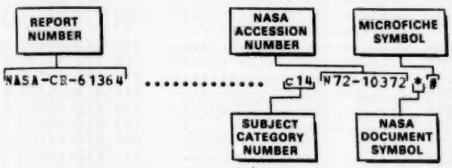

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Vehicle Technology for Civil Aviation—The Seventies and Beyond (NASA SP–292)

The proceedings of a conference held at Langley Research Center, Hampton, Virginia, November 2–4, 1971. The purpose of the conference was to emphasize what can be expected in the future by highlighting promising avenues of research that offer the potential of improving both current and future civil aircraft. The improvements were considered in the context of how they can change the civil aviation picture by providing the aircraft required to satisfy the goals of the future. *Paperbound.* 456 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $6.00.

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